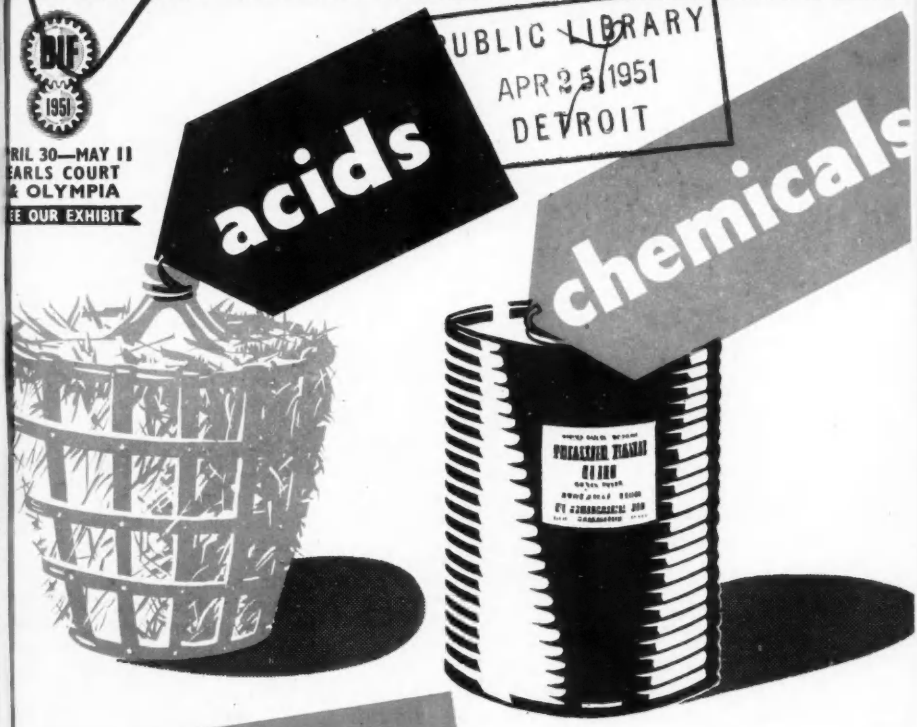
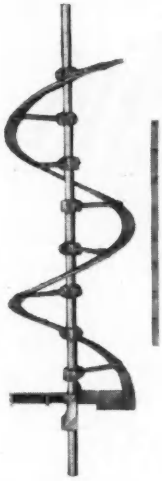
WITH METALLURGICAL SECTION

The Chemical Age

VOL. LXIV 7 APRIL 1951 No 1656





4 ft. 9 ins. diameter stainless steel ribbon stirrer with end clearing bars. Polished all over.

STAINLESS STEEL STIRRERS

For the efficient mixing of solids, liquids and pastes, agitator design is all-important. Jenkins' extensive experience with the numerous different types is regularly drawn upon to ensure correctly controlled processing in vessels operated under vacuum, pressure or atmospheric conditions.

EXPORT ENQUIRIES INVITED.

Robert Jenkins & Co Ltd
ESTABLISHED 1855
ROTHERHAM

Telephone: 4201-6 (6 *lines*)

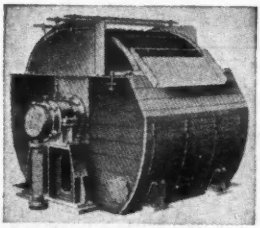
UNIFLOC
REGD. TRADE MARK

Plant for the Chemical Industry

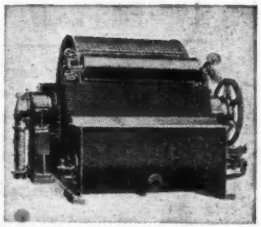
for ACID NEUTRALIZATION, CLARIFICATION OF LIQUIDS, DEWATERING OF SLUDGES, EFFLUENT PURIFICATION, FILTRATION AND FLOCCULATION, PICKLING LIQUOR TREATMENT, PURIFICATION OF TRADE WASTE, SEDIMENTATION AND THICKENING, SEPARATION OF SOLIDS FROM LIQUIDS, SODA RECOVERY. WET MATERIAL HANDLING

Including

AGITATORS CAUSTICIZERS, CLARIFIERS, CLASSIFIERS, CONVEYORS, DEWATERING MACHINES, ROTARY, VACUUM FILTERS, SAND WASHERS, SLUDGE PUMPS, THICKENERS, etc.



Rotary Pulp Washing Machine, with Pitch Pine Trough, Wash Gear and Scraper Knife



Rotary Vacuum Filler, with Take-off Roller and Repulper

UNIFLOC LIMITED
— SWANSEA —

Phone : Swansea 5164 (3 lines)
Grams : Unifloc, Swansea

INDEX TO ADVERTISERS IN THIS ISSUE

APRIL 30 –MAY 11

An International market place

In size and significance the British Industries Fair this year will surpass all its twenty-nine predecessors.

To buyers from every part of the world this vast display will demonstrate Britain's increasing capacity and industrial enterprise.

BIF means business!

LONDON—EARLS COURT AND OLYMPIA. Weekdays 9.30 a.m.—6 p.m. Buyers Badges and Catalogues 2/6 each, obtainable at Fair. Public admitted Saturday and Wednesday (May 5 and 9) 1/6 each building.

BIRMINGHAM—CASTLE BROMWICH. Weekdays 9.30 a.m.—6 p.m. Buyers Badges and Catalogues 2/6 each, obtainable at Fair. Public admitted daily from 2 p.m. (all day Saturday) 2/6.

CHEMICALS AT OLYMPIA

The
Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE 154 FLEET STREET LONDON E.C.4
Telegrams: ALLANGAS FLEET LONDON · *Telephone:* CENTRAL 3212 (26 lines)

Volume LXIV 7 April 1951 Number 1656

The Growth of the D.S.I.R.

THOUGH there will not be a British scientist anywhere who does not know at once what the letters 'D.S.I.R.' stand for, it is very doubtful whether more than a dozen could list the diversity of activities for which this still young body is now directly or partially responsible. As for the non-scientific members of the public it is only too apparent that they can have little conception of what is done in their name for an expenditure of rather less than £4½ million per year. The recent D.S.I.R. Report for 1949-50, its 35th annual report, is no more than an austere digest of the individual reports of fifty-seven separate centres of scientific investigation. Were the D.S.I.R. to publish a fully detailed account of any single year's work, a most cumbersome set of volumes would be required.

The most notable aspect of D.S.I.R. growth in recent years is the development of the Research Associations, joint ventures of state and specific industries. There are now 40 of these centres and 19 of them have been started since the end of the war. Six were set-up during the war. The total sum of grants made to these associations during the year ended 31 March, 1950, was £1,126,392, a little over 25 per cent of the D.S.I.R.'s gross expenditure. This does not mean that industry's own contribution is a similar figure. In the founding of a Research Association, the D.S.I.R. does not offer an annual grant on the £-for-£ basis; an example is given in the Report in which a D.S.I.R. grant of £3,000 per year will be made if the industry concerned provides £5,000; in another case a special grant of £80,000 was offered provided the industry produced £160,000. The £-for-£ basis of joint funding operates only when expansions of already existent Associations' work must be faced. Therefore, if the taxpayer, through the D.S.I.R., is paying over £1 million per year towards the industrial Research Associations, industry itself is contributing an appreciably greater figure.

How can the success or otherwise of a Research Association be judged? In the Report it is suggested that growth in membership, number of inquiries received and demand for the services of liaison officers, will provide a rough measure. A more precise method is to see whether particular advances have in fact been adopted by the industry. It is clear that these are somewhat superficial devices for evaluating research. The first type of measurement may be no more than a consequence of technical backwardness in an industry or in part of an industry; indeed, an excessive flow of elementary enquiries to a research centre

could easily stand in the way of research and turn the organisation into a bureau for technological advice. The second type of test can operate only when real advances have been developed and even then it may take some years before an industry can appreciably install the requisite equipment for adopting the advance. But properly conducted research almost invariably pays handsome dividends. It might be said that research is rarely a gamble with money though it is usually a gamble with time—the dividends will come but no one can predict when. In short, research should be looked upon as a long-term investment. There are indications in the Report that the D.S.I.R.'s Advisory Council is seeking new methods for checking the efficiency of Research Associations. It must be hoped that this will not lead to any form of bureaucratic interference with the independence of the centres. Hitherto, despite its financial contributions probably accounting for about 40 per cent of the total income of the average Research Association, the government has played the rôle of patron and friendly adviser without attempting to assume any functions of inspector. Each Association has its Council drawn from contributing members of the industry concerned; and, on the whole, industry will be the best judge of the value of the research done or of the research in progress. An ineffective Association will soon suffer a marked decline in membership and income.

However, the brief reports of the various Associations for 1949/50 need only be read to show that strength rather than weakness predominates. A particularly encouraging feature in several cases is the co-operation of research workers at one centre with workers in other centres or in the older D.S.I.R. establishments. Almost all the Associations report rapid expansions in their information and liaison services. Regular bulletins, abstracts, and in some cases Year-Books, are issued to member-firms; lectures are given and conferences held. For the smaller Associations this demand for information can present a dilemma for the time and energy of limited staff may be dangerously diverted from genuine research. On the other hand the complete separation of research and advisory work is not desirable; this has been done with the formation of the National Agricultural Advisory Service and many scientists and farmers are increasingly critical of the results.

The Research Association idea has come to stay. It is old enough now to be regarded as 'tried and proved.' The progress recently made in forming so many new Associations, particularly at a time when suitable staff and buildings have been far from easy to find, is a substantial national achievement. Dividends will be paid with compound interest both for the supporting industries and for the country as a whole.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3970). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Commercial Hafnium?

HAFNIUM is not a frequently mentioned element even in metallurgical conversations. It was not discovered until 1923 by Coster and Hevesey although a suspicious gap in the periodic classification had long indicated that such an element existed to be found. The 1923 uncovering was made by the X-ray spectrum method, lines characteristic of an atomic number of 72 being given in the spectra from a number of minerals, particularly those containing zirconium. It has since been found that zirconium is almost invariably accompanied by small percentages of hafnium. As the chemical reactions of the two elements are consistently similar, separation of the hafnium as an impurity in zirconium production has been exceedingly difficult. The atomic energy station at Oak Ridge recently announced the production of metallic hafnium but it appears that this had previously been achieved by chemical methods in unpublished work carried out for the U.S. Air Force. A security ban on the earlier research has now been lifted. Any method of extracting zirconium salts from minerals leads to accompanying amounts of hafnium salts in the same solution. Some crude separation can be achieved by fractional crystallisation. A better method is based on the silica gel adsorption of hafnium tetrachloride from an alcoholic solution, zirconium tetrachloride not being adsorbed. Crude hafnium metal, like zirconium, can be obtained by reduction with sodium. Purification has been achieved by heating the crude hafnium in an atmosphere of iodine; this produces hafnium tetraiodide. At 600°C. this compound vaporises and when brought into contact with a tungsten filament at 2,000°C., the tetra-iodide dissociates and hafnium deposits on the filament. The continued operation of this process eventually yields highly pure hafnium. It is described as a soft metal but it so readily absorbs oxygen and oxidises that its malleability is quickly lost. No immediate commercial uses seem possible though its electron emitting capacity is said to be good and it may find special functions in electronic equipment. So far, however, the arrival of the pure element must be classified as pure rather than applied science.

Systemic Insecticides

ALTHOUGH this country, mainly as a result of Messrs. Pest Control's research, has taken the post-war lead in developing the systemic insecticide, there are signs that America will not be left out of the running much longer. A compound so far known as E-1059 or 'Systox' is being put through development tests and preliminary reports suggest that it may have a greater activity than Pestox III. However, preliminary news from American research centres is often more glittering than the detailed news that is issued later, and it would be unwise to take these early suggestions of superiority too seriously. In fact, the claims that Systox may have a wider range than British systemic insecticides, could be indications of weakness rather than strength. It is the selectivity of systemic insecticides that matters most, not their simple method of application. The wider the toxic range of an insecticide, the less selective is it likely to be. Whether the next contribution in this field comes again from this country or from the United States, it seems fair to point out that the true home of the systemic organic insecticide is Germany. The British development work has been based upon the wartime work of Schrader. It is not uninteresting to note that the new American systemic is also a product of Germany and has actually come from Schrader's laboratory—none has yet been manufactured in the United States—and the quantity now being tested has been produced by Farbenfabriken Bayer.

Sulphur Shortage More Critical

U.S. Forecast of Higher Prices

FULL effects of the current world shortage of sulphur are becoming increasingly apparent in a number of different ways.

Sulphur was recently quoted in the U.S.A. at about $21 to $24 per ton, which includes a price rise of $3 to $4 a ton, which came into effect last autumn.

'Although the necessity of supplying allied countries is causing allocation of sulphur in domestic (U.S.A.) markets, the sulphur industry is filling a very high percentage of the total demand—domestic and foreign—that is being made upon it,' the Freeport Sulphur Co. points out. 'The price of brimstone, meanwhile, has remained low' the company states. 'The present price is about one-fourth higher than the average price for 1935-39, while wholesale commodity prices are more than double the corresponding 1935-39 average.'

'The low-priced, high-quality American brimstone has in recent years displaced other competitive sources of sulphur in many places throughout the world. There are large reserves of sulphur in many forms available for production but at greater costs.'

'While the necessities of our national defence effort may temporarily prevent a sufficient increase in price to permit the restoration of the normal relations between supply and demand, in our opinion the long-range outlook is for higher prices to bring about the production of higher-cost sulphur from the various sources in all parts of the world.'

Trade Drastically Changed

During the past fifteen years, world trade in sulphur has drastically changed. In the late 1930's, before the war, pyrites accounted for more than one-half of the world total, brimstone from the U.S.A. for somewhat over one-quarter, and other sources for the remainder.

During the war, however, foreign production of pyrites and brimstone was badly disrupted and full recovery has still not been effected. United States brimstone has supplied not only the expanded needs of domestic industry but also a much larger share of foreign requirements. Its portion of the total in world trade has risen to nearly one-half (Freeport estimates that world production from all sources in 1950 amounted to 11,700,000 long tons of sulphur).

Two new developments, however, may serve to relieve temporarily some of the pressure on sulphur supplies. From Italy comes word that the Ministry of Supply will take steps to expand sulphur production in Sicily and on the mainland to meet mounting demands for the strategic raw material. Old mines in the Marecchia Valley of Pesaro province on the Adriatic are scheduled to be reopened. Explorations are being carried out round the Adriatic coast to find additional deposits that might be exploited.

Second Development

The second significant new development was the announcement by L. F. McIntosh, Municipal Affairs Minister, that Saskatchewan's sodium sulphate fields may eventually help newsprint manufacturers overcome the sulphur shortage. Although at present sulphur is not commercially produced in Saskatchewan, there are deposits of at least 40,000,000 tons of sodium sulphate. This chemical may be used as a substitute for sulphur in newsprint manufacture, but this would necessitate equipment changes.

In Canada, Mr. R. M. Fowler, president of the Newsprint Association of Canada, has informed the U.S.A. that unless sufficient sulphur is made available, the production of newsprint will be seriously affected. It was, in effect, a question of sulphur or paper.

There is no doubt that the situation is serious, stated Mr. Fowler.

'Sulphur producers in Louisiana and Texas have had heavy demands and have reduced their deliveries, based upon usage from October, 1949, to October, 1950. As present rates of operation of the industry are higher than in that period, the present cut based on the usage is a bigger percentage cut applied to present rates of usage. The pulp and paper industry uses 80 per cent of Canada's imports of sulphur.'

The great proportion of Canadian pulp and paper goes to the U.S.A., pointed out Mr. Fowler. 'Unless additional sulphur supplies are available the shortage will begin to affect newsprint production next summer,' he concluded.

V. F. Gloag Presides at BCPMA Luncheon

Sir Ewart Smith Stresses Need for Co-operation

THE British Chemical Plant Manufacturers' Association entertained at its annual luncheon in the Trocadero Restaurant, London, W.1, on Thursday, 29 March, a large number of distinguished guests, under the chairmanship of Major V. F. Gloag, M.C. The gathering constituted a record numerically. The principal guest was Sir Ewart Smith (Technical Director, Imperial Chemical Industries, Ltd.).

The chairman expressed a very warm welcome to Sir Ewart and his fellow guests, who included the Association's old friends Dr. Frank J. Curtis and Mr. E. B. Lopkes, of the European Co-operation Administration, who were in this country on a special mission to discuss matters with the Board of Trade and the Ministry of Supply. He hoped their visit would be eminently successful from all points of view. The occasion would indicate to them the close co-operation existing between the BCPMA, Government departments and plant users.

There were many representatives of Government departments present, which gave Major Gloag the opportunity to thank them for their co-operation at all times. The defence programme and raw material shortage, he said, called for the closest relationship between the Association and the Government departments, and he was happy to have been assured of even closer co-operation during a trying period.

There were representatives also of trade associations with which the BCPMA worked in close relationship, of the scientific and engineering societies, and of the technical Press, to whose service the chairman paid tribute.

Future Developments

Commenting that the theme of the luncheon was the relationship of the chemical plant manufacturing industry and its users, the chemical industry, he said that big developments were envisaged before the defence programme had come into being, and many of these developments were now closely related with that programme. That would impose a great load on industry and called for a continuance of the closest co-operation between the chemical industry, the BCPMA and the Government. They must have the help of the Government in bearing that heavy load, and he was assured by all with whom he had discussed the matter in Government circles that that help would be forthcoming. As one who had seen the growth of co-operation between the plant manufacturers and the chemical industry over the last 46 years, he said that to-day it was good, but still it was not good enough. The chemical industry must take the chemical plant manufacturers into their confidence a long time before placing an order, so that the plant manufacturers, who had behind them trained chemical engineers, could help in working things out. In a tribute to Sir Ewart Smith, Major Gloag said his activities in recent years had been of great interest to the BCPMA, for he was a member of the Advisory Council on Scientific Policy, vice-chairman of the Lemon Committee and a member of the Chemical Engineering sub-Committee of Lord Hankey's Committee on Technical Education.

A Matter of Supreme Importance

In his response to the toast, Sir Ewart discussed the relationship of the chemical industry and the chemical plant manufacturers. That was indeed, he said, a matter of supreme importance, and it was highly necessary to get it into perspective and to separate it into its more important parts. The chemical industry covered a terrific range of activity, and indeed, there was hardly anything it did not touch in one way or another. The chemical plant manufacturers in the Association again covered a terrific range of work; they specialised in different lines and they engaged in different forms of activity.

Sir Ewart said that those engaged in the industry did not wish to do for themselves what they could obtain efficiently as a service —properly paid for, he hoped—from members of the BCPMA. They wanted nothing more than that the industry represented by the Association should be able to give them the tools with which to do their job.

But all would appreciate that, with the growing scale and complexity of modern works, it was quite inevitable and utterly necessary, if we were to hold and to advance the position of this country in chemical work

as we hoped to do, that there should be co-operation and integration. The scale of operations was so wide and the problems that had to be met were so complex, so much of the work was so new, that we could not do the development work unless we had full and proper integration of everything from the chemical research to the final construction and running of the plant. In some other countries there were chemical engineering consultants and designers who perhaps went rather further than did their opposite numbers in this country. But even there—even in America, in Germany under pre-war conditions and in other industrial countries—the large chemical undertakings, in spite of themselves, were forced by sheer circumstances to do a great deal of that sort of work. It was not that they wanted to do it, but simply that they had to do it.

Building New Plant

He did not think the chemical industry thought for a moment of designing and building its own chemical plants or gas plants or its own standard types of sulphuric acid plants; and certainly it did not want to design or make its own filter presses or pumps. There was terrific scope in all those things, and in so far as the plant manufacturing industry could develop its facilities to enter into a wider field, speaking for himself, he felt sure he could say also for the chemical industry, that they would have nothing but welcome and help and co-operation to give to that end.

There were four essential components in the difficult work of developing and building new chemical plants for new processes. First there was the research angle which provided the fresh knowledge, secondly, the manufacturing side which made the plant when it was specified, thirdly the user (the plant manager) who said what he wanted or thought he wanted, and lastly and centrally, the designer. If we imagined the first three parties as representing the corners of a triangle to the designer—using the term 'designer' in the widest sense—it was he who represented the key section, linking the other three together; it was he only who could unite the needs of the user to the fresh knowledge that came from research; he had to draw a balance between what were often conflicting requirements and possibilities.

In this country we were perhaps only just beginning to realise the essential need for a sufficiency of men; he did not mind where they came from, whether they came up from the drawing office or from the universities, but we did need a sufficiency of men who, by training, knowledge, experience and ability were able to fulfil that most difficult function of speaking to the scientist in his own language without necessarily doing his work, of understanding the problems and difficulties of manufacture, and at the same time the requirements and the very great difficulties of the user. It was necessary that designers should be men of high ability and that they should themselves, or with members of their teams, co-ordinated, have had experience of the other three stages.

Sir Ewart said he had been in a research department on more than one occasion and he had some appreciation of the research approach; and he was a most profound believer in research. But we should not put research on such a pedestal that it was out of proportion to the other functions he had discussed. After all, what was the use of all the knowledge in the world if we could not apply it? It had been said often enough, but he would make the point again because we could not beat it into ourselves too often, but how much effort had we devoted in this country to achieve wonderful results in the field of pure science and to achieve knowledge which other people had picked up and turned to their advantage more quickly or to a greater extent than we had done ourselves?

Application of Research Important

All honour to our scientists; he did not suggest for a moment that we should relax on that front, but for Heaven's sake let us appreciate what was necessary in the provision of trained technical minds. He was speaking of what he preferred to call the applied scientists—and he included engineers of all kinds, chemical engineers and applied chemists—who would take the knowledge gained by research, understand its meaning and potentialities, and use it promptly and effectively in order to gain the benefit of the brains and ability that was behind it.

In some cases research was done in industry; but very often industrial concerns, because of their size or because of their inherited traditions or outlook, did not themselves carry out research in what he called an effective and understanding manner. He believed most profoundly that it was not possible for an organisation in that field to utilise the fruits of research unless it was itself active in that field and used people who

were trained in carrying out research, so that they could appreciate what others were doing and could deal with the many ancillary problems that were always bound to arise when trying to apply other people's results. It could be a positive dis-service if industries or firms took the view that, because they supported a research association, there was no need for them to do anything themselves. He believed it was far better for the results of the efforts that were put into the research associations to go where they would be right up against the actual users, the designers. We in this country had been pre-eminent in making available to all the fruits of our basic and fundamental research work; but he did not think we had been as good as we might be, or as good as were some other countries, in making the fruits of our work available at the applied end. His own organisation fully realised this, and in so far as they could make available knowledge that would be of general use and applicability, knowledge which came out of their own work, carried out at their own expense, they would be the first to do so. They had issued a handbook, one of a series they hoped to bring out, on statistical methods in that field. He hoped there would be another this year on mechanical forced-draught cooling towers; another would deal with welding. He hoped those handbooks would contain something which was new; certainly they were trying to put into the handbooks the best that they knew. Sir Ewart appealed to everybody to be open to the widest possible extent in letting other people know the good things they had found, and equally the things which it had been found necessary to avoid; it was often just as important to know what not to do as to know what should be done.

Synthetic Fibres

Recalling his view that there was in the ever-growing chemical industry terrific present and future scope for the members of the Association, Sir Ewart mentioned the field of synthetic fibres which was just beginning to open up. He did not mean fibres of the rayon type, which came essentially from a natural base, but fibres of the truly synthetic type such as nylon, and so on. In the chemical industry it was believed that that sort of business—and although he had mentioned only fibres, there were plastics and other fields which were comparable—was in its infancy. In the world today the average amount of cloth received per individual per annum was said to be only three-quarters of a yard. In 1949, the last year for which he had figures available, in this country we used something like 19×10^8 lbs. of natural fibres, i.e., cotton, wool and silk, and we used 2.9×10^8 lbs. of rayon. Nylon represented a mere fraction of 1 per cent (its use was growing, but it was still small), and other things were yet to come. When we considered the general trend of world events, or world population and world supplies of natural materials, there could be no doubt whatever that the scope for that sort of work in the strictly chemical field was, so far as we could see in our lifetime and in that of our children, just illimitable.

Face the Future

Do not let us be afraid, therefore (he said), that we should work ouselves out of jobs; let us rather put ourselves into a position to meet the very dufficult problems that have to be faced. With all humility and deference, not because he belonged to a big organisation, but speaking as an engineer, Sir Ewart begged all concerned to make sure what they wanted to do, what they wanted to make and what they would specialise in, because specialise they must if they were to survive. He did not even mind if some firms or associations decided to specialise in non-specials. 'Let us in each of our organisations have a clear-cut policy that we were going to tackle something within our scope and ability; let us set a target, make ourselves so efficient that in a chosen field we could compete with anybody, big or little, and beat them,' he said. If we did that we should grown efficiently.

On the question of prices he said it was possible to kill the goose that laid the golden eggs; and when a manufacturer had to assess plant on a large scale, major types which cost up to £1,000 capital per ton-year of product, and convert that back, with its obsolescence and its interest, and the necessity for it to earn reasonable interest, it was quite clear that the capital charges could easily be equal to all the other costs involved in a process, or more than equal.

Enlarging upon his point concerning the need for the education and supply of technically trained staff, he said that if we were to see the progress that he would expect and postulate, it had to come, not by harder physical work, but by better thinking, better brain power, better design; it had to come from brain and not from brawn. It was of

no use grumbling because the workmen did not work harder; progress had to come from technical management in this industrial age.

The Association

As a member of a Sankey Sub-Committee on technical personnel he paid tribute to the BCPMA and, indeed, to the industries who used chemical engineers or were thinking of using them, for the relative boldness of their conception, for their obvious appreciation of the importance of progress. There were some who, in his view, had a rather static outlook, but the Association had not. The Association had said that in 1938 it had 60 chemical engineers, in 1949 it had 239, and in 1954 it expected to have 348; that was a very nice rate of progression. Long may it continue, and may the universities and colleges turn out the people who could meet the demands. Certainly there was a most clamant need, and there was nothing more urgent and important than to press forward on that front. He had been somewhat amused recently to read that in the United States they were getting worried about the supply of engineers. For a long time they had been turning out 15 times as many as ourselves, 5 per cent per head of the population. It was also stated that they were getting worried because they were behind on the pure science side, and they were setting themselves up to get on with that. But our side of the problem was that of applied science; anything we could do—and the Association had helped —we should do. He wanted to see the people concerned go right through industry to all positions and all levels; and the further they went, the greater would be the demand for others of the same kind, and we should have more people using their brains rather than turning valves and sweeping floors.

Newcastle Chemical Industry

THE 32nd annual general meeting of the Newcastle Chemical Industry Club was held on 15 March. The club activities were continued during the year and the high standard of the talks was maintained, although attendances were somewhat disappointing.

The following officers were elected for 1951-52:—*President Emeritus*: MR. A. TROBRIDGE; *president*: MR. R. H. F. HOUSTON; *vice-presidents*: PROFESSOR G. R. CLEMO, D.Sc., MR. CLIVE COOKSON, MR. J. W. CRAGGS, MR. B. P. HILL, DR. G. E. STEPHENSON, MR. ARTHUR KELLY, MR. H. DUNFORD SMITH, M.Sc., MR. S. A. WIKNER, F.R.I.C.; *chairman*: MR. W. S. COATES; *hon. librarian*: MR. S. IRVIN; *hon. treasurer*: MR. S. DAWSON; *hon. secretary*: MR. W. A. BRIGGS; *committee*: MESSRS. L. BONSER, F. BELL, A. MCGUCKIN, W. JEFFERY, B. RICHARDSON, H. THOMPSON, J. WINGATE, W. WINSHIP.

Terylene Council Set Up

A 'TERYLENE' Council has been formed to assume responsibility to the Board of Imperial Chemical Industries, Ltd., for the 'Terylene' project (working through the existing Divisional framework) and to co-ordinate research and development work in I.C.I. on all synthetic fibres, excluding nylon and 'Ardil.'

Dr. A. Caress has been appointed chairman of the council, of which the other full-time members are Mr. G. F. Whitby, Dr. R. Beeching, Mr. Rowland Hill (I.C.I. Dyestuffs Division), Dr. E. D. Kamm (I.C.I. Plastics Division), and Mr. W. F. Osborne (I.C.I. Plastics Division).

Dr. J. C. Swallow succeeds Dr. Caress as a joint managing director of the Plastics Division of I.C.I. Mr. E. G. Williams has been appointed to the Plastics Division Board and succeeds Dr. Swallow as Research Director.

A Century of Science

'THE BRITISH contribution to science and technology in the past hundred years' will be the title of the presidential address by the Duke of Edinburgh at the opening meeting on 8 August of the 113th annual meeting of the British Association for the Advancement of Science.

This year's meeting will be held in Edinburgh and is the sixth to be held in that city. The Duke is the third member of the Royal family to hold office as president.

Although a large number of items in the programme will be concerned with progress since 1851, many topical subjects will be discussed and many of the papers will look ahead rather than backward.

Subjects will include: chemistry in the service of mankind, higher technical education, and 'natural and artificial production of atmospheric precipitation.'

MIDLANDS ANALYTICAL METHODS DISCUSSION GROUP

Some Aspects of Boron Analysis

TECHNIQUES employed in boron determination and problems involved in the examination of a wide range of materials containing boron in varying amounts were discussed at the seventh meeting of the Midlands Analytical Methods Discussion Group, held recently in Birmingham. The topic was introduced by two speakers, Mr. G. R. Ball (Borax Consolidated, Ltd.), and Mr. J. Davies (Chance Bros., Ltd.).

Boron determinations may have to be carried out in the examination of pure compounds such as borax, boric acid, and so on, began Mr. Ball. Among the materials in which differing quantities of boron might also have to be determined were borate ore, glasses, glazes, vitreous enamels, fluxes, detergents, adhesives, fertilisers, alloys, and textiles which have been flame-proofed with borax and/or boric acid. Estimations sometimes have to be made on plant materials which generally contain minute quantities of boron.

Three techniques which have been found particularly useful are:—

The ordinary volumetric method (using mannitol and standard sodium hydroxide); electrometric titration; and colorimetric estimation.

Chemical considerations apart, the three techniques are useful in providing convenient means for dealing with widely varying amounts of B_2O_3; thus, a quantity of B_2O_3 of about 0.1-1 g. is conveniently estimated by ordinary titration (macro scale), electrometric titration is particularly suitable for about 0.1-10 mg. while colorimetric methods are useful for quantities of 2-15 μg.

Phenolphthalein Indicator

This normal volumetric method makes use of the fact that, although boric acid is in itself too weak to be titrated, it forms, in the presence of various polyhydric alcohols, a complex of sufficient acid strength to be titrated with sodium hydroxide using phenolphthalein as indicator. Under these conditions one hydrogen ion is titrated for each atom of boron present.

In carrying out the titration, any strong acid or alkali present is first neutralised using an indicator unaffected by free boric acid, such as methyl orange or methyl red. Mannitol and phenolphthalein indicator are then added and the titration carried out with standard sodium hydroxide.

Glycerol may be used instead of mannitol but is not recommended. A large amount must be used and the end point is not so sharp. Traces of iron and alumina do not interfere if methyl red is used for the first end point, but larger amounts make the recognition of this end point difficult, and a modification to overcome this is necessary. Phosphate causes interference and must be removed by precipitation as the calcium or lead salt. Separation may also be achieved by distillation of the boron as methyl borate.

Most Usual Method

This titration is in most cases the means by which B_2O_3 is ultimately determined. Various procedures, however, have to be employed to obtain a solution suitable for titration.

With ore readily decomposed by acid, digestion with dilute hydrochloric acid followed by filtration may be used.

If iron and alumina are likely to be extracted by the acid, a method using barium carbonate to precipitate these impurities yields a sharper methyl red end point. The ore is decomposed using only a slight excess of hydrochloric acid. Bromine water is added to oxidise iron and the excess bromine boiled off. The hot solution is then neutralised by the addition of finely ground barium carbonate, of which a slight excess should remain. This procedure precipitates iron and alumina. The solution is filtered and B_2O_3 determined in the filtrate in the usual way.

In the case of ore not readily attacked by acid, glasses, enamel frits and so on, it is first necessary to fuse the material with sodium carbonate. The melt is dissolved in acid and may then be dealt with in several ways, for example, by distillation of the boron as methyl borate.

This latter is a general method of isolating B_2O_3 and may be used with a variety of substances including plant material. Practical details vary somewhat in different methods, but the underlying principle is the same.

The boron-containing material, after any necessary pre-treatment such as alkali fusion or ashing, is placed in a distillation apparatus and acidified to liberate boric acid. Water is distilled off, the outlet of the condenser dipping into dilute caustic soda solution.

Methyl alcohol is then added to the flask, where it reacts with the boric acid to give methyl borate. The latter is distilled over, together with excess methyl alcohol, into the soda solution, where hydrolysis occurs. Methyl alcohol is then evaporated off from the solution, which must be fairly strongly alkaline to avoid loss of B_2O_3. CO_2 is removed and B_2O_3 titrated in the usual way.

Distillation Disadvantageous

Isolation from all the common interfering substances except fluorine is provided in this way. Although the method is superficially attractive, distillation is tedious to carry out and it is somewhat difficult to obtain quantitative recoveries.

In the titration methods of Wilcox, and Hollander and Riemann, the *p*H of the solution is adjusted to some suitable value, mannitol added, and the solution titrated back to the same *p*H value with standard sodium hydroxide. Although the technique of employing the same empirical *p*H value for the two end points introduces a slight error, it is very convenient in that only substances reacting with mannitol are titrated.

Interference from most of the more common radicals with the exception of phosphate is automatically eliminated. Another very important advantage is that low concentrations of B_2O_3 can be accurately titrated in this way (0.2 mg. B_2O_3 in about 50 ml. solutions can be titrated to within about $\pm$ 2 per cent.

The end point error appears to be least when a *p*H value of 6.3 is employed. Hollander and Riemann give a table of corrections to allow for this error, which may, however, be sufficiently compensated for by standardising the sodium hydroxide against B_2O_3 by a similar electrometric titration.

Because of the empirical nature of the method, the standardising conditions should roughly simulate the conditions of use in respect of solution volume, concentration of B_2O_3 and sodium chloride. Normally this leads to a solution factor about 2 per cent higher than the stoichiometric value.

Adjustment of the solution may be made to *p*H = 6.3 using a *p*H meter, or more conveniently a null method with a galvanometer. The latter method makes use of the fact that a quinhydrone electrode in conjunction with a calomel electrode containing 1.2 per cent KCl gives zero potential in a solution of *p*H = 6.3. The two electrodes are connected through a high variable resistance to a sensitive galvanometer which shows no deflection at the required end point. The resistance in circuit is reduced to give increased sensitivity as the end point is approached.

The quinhydrone electrode simply consists of a piece of bright platinum wire immersed in the solution to which has been added about 40 mg. quinhydrone for 50 ml. solution. Mechanical stirring is desirable. In carrying out a titration by the null method, the electrodes are immersed in the slightly acid solution, the variable resistance adjusted so that the galvanometer deflection is convenient and standard caustic soda added from the burette. The deflection will decrease and the series resistance should be reduced to give greater sensitivity when the deflection has become small.

When the deflection is zero, the burette is read, and mannitol is added, which causes the deflection to increase again in the original direction through formation of the more strongly acidic boric acid-mannitol complex. Standard sodium hydroxide is again added from the burette until the deflection is restored to zero, when the burette is again read. The difference in the two burette readings is a measure of the B_2O_3 present.

This method may often be applied without any preliminary purification of the solution. Thus B_2O_3 has been estimated in dextrin adhesives by direct titration of a solution.

Risks of Contamination

Boron in plant material may be estimated by electrometric titration. The material must first be ashed and phosphate, if present, removed before titration.

In all micro estimations of B_2O_3, care must be taken to avoid accidental contamination with B_2O_3 from beakers and so on, which are usually made of borosilicate glass. Acid solutions may be handled fairly safety, though it is advisable to limit the time of contact as far as possible. With alkaline solutions the danger of contamination is greater and borosilicate beakers should be

avoided. If soda-glass apparatus is not available, vitreosil crucibles or beakers may be employed.

Colorimetric methods are useful for the estimation of very small quantities of B_2O_3 (2 — 15 μg.) and for routine control purposes where small amounts have to be determined. The colour reaction with quinalizarin in sulphuric acid appears to be the most convenient method. Methods using turmeric (or preferably curcumin) both in solution and in paper form (analogous to the Gutzeit test for arsenic) are available but do not appear to offer any special advantages. Various other organic reagents have been proposed for colorimetric estimation of B_2O_3, such as carmine, 1 : 1′-dianthrimide, but these have not as yet been sufficiently investigated.

Quinalizarin gives a purple coloured solution in slightly diluted sulphuric acid. Traces of B_2O_3 change the colour to a more bluish shade. The reaction is sensitive towards water, more water changing the colour back towards purple. The quantity of water must, therefore, be carefully controlled.

Non-interference of phosphate and the high sensitivity of this test make it particularly suitable for the estimation of boron in plant material where quantities of 50 p.p.m. B_2O_3 may have to be determined.

In examining plant material, the organic matter must first be burnt off in the presence of alkali to prevent loss of B_2O_3. This is most conveniently done by mixing the sample of the plant material with saturated lime water in a platinum or silica crucible. This mixture is evaporated to dryness, charred and gently ignited to burn off carbon. The ash is left in a porous form so that the carbon is burnt off easily and the residue dissolves readily in dilute acid.

A Sintered Residue

Sodium carbonate is sometimes used as the alkali in ashing operations, but it is not recommended as it leads to a sintered residue containing much carbon, which only dissolves very slowly in acid. Again, it necessitates the use of a platinum crucible, whereas silica crucibles may be used with lime.

The ash is dissolved in 1 per cent sulphuric acid, the solution clarified by centrifuge if necessary, and an aliquot of the solution used for the colorimetric test as described above.

The importance to the glassmaker of the estimation of boric oxide in glass was emphasised by Mr. Davies, who took up the discussion. Boric oxide is a common constituent of many glasses. In boron flint optical glasses it may be present in amounts up to 45 per cent, in heat-resisting glasses in amounts varying beween 8 and 14 per cent and in table glassware in amounts varying between 0.5 and 2 per cent.

Three Methods

Current methods for its determination make use of the volumetric finish where the boric acid is titrated with sodium hydroxide solution in the presence of mannitol. Silica and interfering bases must be removed, three methods of effecting this being available. The first is the well known Wherry process which has been so improved upon by recent work that it compares favourably in accuracy with the more elaborate methods. The second is the partition process described by Glaze and Finn which is based upon the partition coefficient of boric oxide between ether and water. Finally, there is the distillation process where the boron is removed from interfering substances as volatile methyl borate.

Physical methods for the estimation of boron in glasses are not widely used except for the estimation of trace amounts of the element.

In the Wherry process the powdered glass sample is fused with a weighed amount of sodium carbonate in a platinum crucible, the melt extracted with water and filtered under suction through filter paper pulp. The filtrate is acidified with a measured amount of hydrochloric acid, and the excess neutralised with solid calcium carbonate, a small quantity being added in excess.

To precipitate silica and alumina the mixture is then boiled under reflux and the solution filtered again under suction. The filtrate is boiled in the presence of a trace of calcium carbonate, cooled under reduced pressure and titrated with 0.1N carbonate-free sodium hydroxide, in the presence of mannitol using phenolphthalein as the indicator. The method is rapid and has the great advantage that no special apparatus is required.

The partition method, which is rapid and reasonably accurate, is especially useful when many determinations of boron are to be made on glasses of the same type. It

is based on the relative solubilities of boric acid in water and an ether-ethanol mixture.

Ether alone will not extract sufficient B_2O_3 from the aqueous solution to be satisfactory but it has been shown that the 'Partition Law' applies in the case of mixed solvents. The ratio of boric acid dissolved in the ether layer to that in the water layer is a constant which may be determined experimentally or the value worked out by Glaze and Finn accepted.

Semi-Micro Scale Adaptations

In the distillation method, boron is separated by distillation as methyl borate. It has two disadvantages; it is lengthy and considerable quantities of pure methyl alcohol are required. Chirnside and Dauncey have adapted the method to the semi-micro scale with a consequent saving of time and material, and Brewer has suggested modifications. When the apparatus is set up and standard solutions prepared, an estimation can be completed in a day.

Apparatus consists essentially of a 250 ml. distillation flask acting as a boiler for methyl alcohol, a 50 ml. distillation flask acting as the reacting vessel, a condenser and a receiving flask.

Low expansion boron-free glass should be used throughout, but good results are obtained with borosilicate glass apparatus if the receiver and its capillary boiling tube are made of boron-free glass. The titration flask must also be boron free.

Rubber bung connections are satisfactory when made from finest red rubber; they are attacked slightly by hot methanol when new but the attack soon ceases. Tin foil may be used to insulate the rubber.

N/20 sodium hydroxide is prepared free from carbonate by allowing a highly concentrated solution to stand in a 'boron-free' vessel and a measured amount of the clear supernatant solution withdrawn for dilution and ultimate storage in a Pregl micro burette.

Anhydrous calcium chloride of 14 to 20 mesh is convenient and it is advisable to purify it by evaporating with methanol saturated with HCl gas and subsequently drying at 200°C. This precaution is to remove any boron which may originate from the glaze of the refining vessels and which would be mainly on the surface of the granules.

Bromothymol blue indicator is prepared by dissolving 0.04 gm. of the free acid in 1.3 ml. of N/20 sodium hydroxide and diluting to 100 ml. and filtering.

A buffer solution, *p*H 7.0 is prepared by dissolving 1.69 gm. citric acid and 11.70 gm. Na_2HPO_4 in water and diluting to 500 ml.

Determination is carried out by fusing the sample with sodium carbonate and decomposing the cake with water. Meanwhile, calcium chloride is transferred to the distillation flask and the aqueous extract added to it, transferring with small amounts of 1 : 1 HCl and water. The apparatus is then connected up and the distillation carried out. The distillate is made alkaline, the methanol removed by distillation or evaporation, and the residue diluted, acidified, refluxed to remove CO_2 and cooled under reduced pressure.

Bromothymol blue indicator is added, followed by standard sodium hydroxide from the burette until the *p*H is 7.0. Mannitol is added and the titration completed with standard sodium hydroxide until the *p*H is 7.0.

A blank determination is made by fusing pure silica with Na_2CO_3 and following the method as with the glass sample.

The determination of traces of boron in glasses does not generally concern the glassmaker, although it may be required to provide evidence of the possible contamination of one type of glass with another. It is also required in the manufacture of low-expansion 'boron-free' chemical ware.

There are no recognised standard methods, but the colorimetric procedures recommended for soil analysis are applicable. The curcumin and quinalizarin methods are the best known. In each case the boron is first separated by distillation as methyl borate.

With curcumin the distillate is made alkaline with calcium hydroxide and evaporated.

Colour Comparison

With quinalizarin the residue left after removing methanol is taken up with 93 per cent sulphuric acid and the colour matched by comparison with a standard series. Beers' law holds within narrow limits and the colour can be matched in Nessler glasses by adding a standard solution of boric acid in 93 per cent H_2SO_4 to the blank, or the transmission may be measured by absorptiometer.

There are disadvantages—first, the obvious one of having to work with 93 per cent H_2SO_4, the difficulty of obtaining H_2SO_4 sufficiently low in boron, and, finally, the possibility of the influence of arsenic which is a common trace constituent of glasses.

Gas Turbines and the Chemical Industry

Great Flexibility Aids Variety of Processes

POSSIBLE industrial applications of the gas turbine, with particular reference to the chemical industry, were surveyed by Mr. I. Lubbock, head of the internal combustion turbine section, Shell Refining and Marketing Co., Ltd., in a paper delivered recently at a meeting in London of the Chemical Engineering Group (Society of Chemical Industry).

Starting with the theoretical aspects of the gas turbine, Mr. Lubbock showed how although it could, of course, be used as a prime mover, its extreme flexibility was probably the main point of interest in its application to chemical processes.

In its simple form the gas turbine consisted of a compressor, a combustion chamber and a turbine. Air was compressed near-adiabatically, heat added at constant pressure and the gas finally expanded again in near-adiabatic fashion. In its ideal form the cycle efficiency was equal to that of the air-standard cycle but component inefficiencies and pressure losses limited the achieved values.

Practical chemical engineers would want to know the thermal efficiency of the machine and its prospects for the future. Since the machine had a separate component for each thermodynamic process it was possible to give an estimate of the value of each of the refined steps to improve thermal efficiency.

Most Important Factor

The most important factor in an open cycle gas turbine was the turbine inlet temperature. The higher this value, the greater the thermal efficiency. A simple cycle consisting of compressor, combustion chamber and turbine would, with a turbine inlet temperature of 650° C., give an overall efficiency of 18 per cent. This was achieved with low capital cost, small space requirement and practically no water requirement. For every 100° C. by which the turbine inlet temperature was raised, an absolute value of 3 per cent was added to the thermal efficiency, so that in the future with improved heat-resisting steel and better blade cooling a thermal efficiency of 30 per cent would be achieved with a turbine inlet temperature of 1,000° C. The corresponding specific output increase would be even more striking.

Present-day gas turbine designers employed recuperation of the turbine exhaust gas to increase cycle efficiency.

Prospects for the future would be enhanced if turbine designers found improved methods of blade cooling and if metallurgists could produce steels of high creep strength at elevated temperatures. In the last 10 years turbine admission temperatures had steadily climbed, in some cases to as much as 750° C.

Before dealing with applicational problems, the author pointed out the flexibility of the machine in its ability to operate on a large variety of fuels. To date much experience had been gained on distillate fuel oils, but several plants were already operating on residual fuel oil.

Solid Fuel Experiments

Solid fuels such as peat and coal were being experimented with although consumption of these would have to be viewed critically owing to the increased capital expenditure on the plant. The combustion of natural gas had received attention, and in this case the technical problems were even less than with distillate fuel.

Features of the aircraft gas turbine combustion chamber design had had a marked influence on its industrial counterpart. The undesirability of low-rated combustion chambers had led designers to heat release rates between a normal oil-fired boiler on the one hand and an aircraft combustion chamber on the other.

Some publicity had been given in the last year or two to the effects of the ash content of fuel oil. The heaviest grade of fuel oil was not likely to contain more than about 0.1 per cent ash, the major constituents of which were vanadium and sodium. Troubles which might be encountered were those of the chokeage of turbine blade passages and the possibility of high temperature corrosion of the turbine blade materials.

So far as ash deposition was concerned, trouble had been encountered in some machines which had been sufficient for inquiries to be pursued as to the nature and cause of the deposit. The sodium salts were suspected to be the bonding agent and it was fortunate that these salts were water soluble. Thus regular treatment of the

deposits by water washing could minimise this trouble. Other gas turbines were in commission in which the trouble had not materialised.

Increase of turbine admission temperatures would cause corresponding increases in blade temperatures and vanadium attack might result above a temperature of 650° C. Investigation of the metallurgical problem had shown that high nickel alloys offered moderately successful resistance to this form of attack although further research was being directed to provide materials of added resistance, towards the use of chemical additives to the fuel and to gas cleaning devices between the combustion chamber and turbine.

Combination Plant Described

Combination of a gas turbine with a waste heat boiler was described. Virtual independence of steam and power outputs was obtained by fitting the waste heat boiler with an auxiliary burner. Alternatively, or in addition, a throttle valve could be placed between the turbine and the boiler. Without the use of these refinements, it would be appreciated that the steam generated fell with decreasing power output.

An interesting point to chemical engineers was that this seam could be used in existing turbines which might be outdated for continuous service, but could be run for short periods. This would mean additional electrical power without additional steam turbine investment costs.

Similarly, there were many old power plants in which boilers were being de-rated. With minor alterations these could be converted to waste heat boilers for gas turbines thus saving the investment cost of the boiler.

In the petroleum industry the use of gas turbines for compressing air by utilising waste heat as in the Houdry Plant was too well known to need amplification. Over 30 such gas turbines had given satisfactory service.

Gas turbines compounded with diesel engines and steam turbines were also described and the advantages outlined.

The possibilities of the gas turbine for waste heat recovery and auxiliary power generation in the coal carbonisation industries were now being exploited. The general arrangement of a plan ordered by the West Midlands Gas Board was described.

Elimination of costly steam boilers and condensing equipment by application of the gas turbine cycle to blast furnace use was possible because the air requirements of the furnace could be supplied from the compressor of the gas turbine set.

Methane occurs in the upcast from collieries in concentrations up to about 1 per cent. Since this was of the right order for a gas turbine, it was possible to liberate this heat in a gas turbine and provide the power required by the collieries.

To get such a mixture to burn, however, a considerable amount of preheating was necessary. If the methane was used in concentrations greater than about 1 per cent, dilution with fresh air would be applied. It was more likely, however, to be used where concentrations fall below 1 per cent when an auxiliary fuel would need to be burned.

The author concluded his paper with a summary of the wide appeal of the gas turbine to the transport engineer for air, land and marine purposes.

Canadian Joint Enterprise

FOR some time it has been rumoured that the British American Oil Co., Ltd., and Shawinigan Chemicals, Ltd., have been making joint studies of a major petrochemical development to be located in Montreal East.

It is now learned on excellent authority that these two companies will form a jointly owned petrochemical company and that engineering studies of a number of projects are well advanced. It is also understood that plant construction will be started within a few months using a newly developed process which promises substantial economies in the production of certain basic chemicals which are now in great demand.

If the development proceeds as expected, Canada will have taken another step towards economic independence. Both B.A. Oil and Shawinigan Chemicals are Canadian companies. The raw materials will be produced in Canada, and the chemical products will be utilised by Canadians in their own factories.

Solignum in Durban

The wood preservative solignum is now being manufactured locally by Lewis Berger & Sons (S.A.), Ltd., Durban, under an agreement with the British firm Solignum, Ltd. It is available in containers ranging from one to 40 gallons.

Chemical Developments in Finland

Sulphuric Acid a Major Product

FINLAND has a fairly considerable chemical industry, which has been built up during the last 100 years, and more particularly during the last 50 of them. This has been made possible largely by her great natural wealth in timber and minerals.

Among the minerals copper takes first place, and the mines, some of which also yield arsenical pyrites and tungsten ores, are mainly worked by the State Outokumpu A.G. Other minerals are ores of zinc, nickel, gold, silver, platinum and selenium.

Sulphur is largely present in some of the minerals and is utilised in the paper and pulp (sulphite cellulose) industries. The iron content is, however, no longer recovered by the Vuoksennista A.G., as it became uneconomical. This concern also has large interests in gold mines at Haveri, and blast furnaces in Imatra and Turku; while there are important State metallurgical works in Harjavalta and Pori, belonging to the Outokumpu A.G.

Copper production in 1949 was 21,000 tons (25,000 tons, 1948), sulphur concentrates 176,000 tons (178,000), and zinc concentrates 5,100 tons (5,100). Limestone is fairly plentiful, and there are several lime and cement works, such as those of Pargas Kalkbergs A.G., and Lojo Kalwerk A.G. Cement production is increasing, and has risen from 420,000 tons in 1947 to 656,000 tons in 1949.

Dr. Ing. Y. Talvitie, of Helsinki, writing on these and other chemical developments in Finland (*Chem. Industrie*, 1951, *3* (2), 69-70) states that manufacture of sulphuric acid began about 27 years ago, and there are now three factories with four plants—three using the vanadium catalytic and one the chamber (Petersen) process. Total capacity is 125,000 tons 93 per cent acid, but actual production was 89,000 tons, in 1949, an increase of 23,000 tons over preceding years. Two-thirds of the output is used in superphosphate manufacture, or the less acid Kotka phosphate. The total capacity is 550,000 tons, all of which is in the hands of the State A.G. Rikkihappoja Superfosfaati Oy, with plants in Orten and Kotka.

Details of some of the other chemicals may be tabulated as shown at foot of page:

In other sections of organic chemical industry some progress has been made in the last year or two with synthetics, largely by the cellulose group. Kymmene A.G. have chlorine and carbide plants and manufacture tri- and perchlorethylene and pentachloro-phenolate; A. Ahlström Oy, dichlorethane, glycol, chloral, chloroform and abietates at Warkaus; Wärtsilä-Selluloosa Oy, cellulose glycolate, solvents and wetting

	Production (tons) generally 1949	*Principal companies and factories*	*Remarks*
Inorganic			
Hydrochloric acid	3,000	—	—
Alkali phosphate	—	Kymmene AG (1885)	—
Waterglass	—	(No longer manufactured)	—
Electrolytic chlorine and soda	Cl 13,000	Kymmene AG in Kuusankoski Finnish Chemicals AG in Aetsa	Two plants taken by Russians
Potassium chlorate	2,000	Swedish Match Trust, in Imatra	—
Hydrogen peroxide	66	Woikoski AG	Since 1937
Calcium carbide	6,000	Kymmene AG, Voikkaa	—
Nitrolime	3,000	Kymmene AG, Voikkaa	—
Ammonia (Synth.)	16,000	New works at Oulu	And derivatives
Ammonia (Gasworks)	Small	Helsinki gasworks	—
Ammonia (Dry ice)	1,200	Two plants	—
Sodium sulphate	—	By-product of viscose works. Large quantities imported.	—
Oxygen and acetylene	—	Several small works, also Kymmene AG	—
Organic			
Cellulose (sulphate)	558,000	29 factories	Turpentine and tall-oil byproducts in 3 factories for refining.
Cellulose (sulphite)	863,000	20 factories	
Viscose products,	—	—	—
Wood charcoal, etc.	—	Numerous, relatively small	—

agents; Enco-Gutzeit Oy, methanol, formaldehyde, etc., at Imatra; and Vihtavuori Oy, ethers, active charcoal and various plant pest preparations.

The plastics industry is mostly in the hands of three firms: Ahlström Oy, Sarvis Oy, and Tammer Tehtaat Oy at Tampere. The chief products are phenolformaldehyde, urea and casein plastics and resins. Seven firms manufacture paints and lacquers with total output in 1949 of 7,000 tons. The leading firm, established since 1862, is Schildt & Hallberg A.G., of Tikurila, formerly of Helsinki. Production is not sufficient to supply the home market.

Some linseed and other vegetable oils are produced; and four plants in 1949 manufactured about 4,000 tons of varnishes, but no tall oil is now used for the latter despite the fact that 12,500 tons of this were produced in 1949—a slight decline from preceding years.

Soap manufacture engages ten factories, to the extent of 9,000 tons a year, and these are now using large amounts of tall oil fatty acids; tall oil soaps are now made (2,700 tons). Among the oldest firms is Havi A.G. rating from 1829. About 4,000 tons of washing powders are also made annually.

Several firms are engaged in the manufacture of pharmaceuticals but only two are of any considerable size, namely, Firma Orion and Firma Medica, both of Hensinki. Two relatively new firms have been established at Turku. Products are chiefly galenicals and other comparatively simple drugs. Others and much of the raw material needed are imported.

Match Industry Important

The match industry is, of course, fairly important and five firms produce about 380 million boxes per annum. Explosives are made by Finska Forcit-Dynamit Ab, in Hanko, and the large state concern Vihtavuori Oy.

Industries based on wood and cellulose naturally occupy an important place. Total cellulose production in 1949 was just over 1,000,000 tons. Practically all the sulphite works produce alcohol or yeast from the lyes, and yield of former in 1949 was 23,000 tons. The sulphate mills produce terpentine oil and tall oil as important by-products, for which there are three refineries: Enso Gutzeit Oy, Kemi Ab, and Oulu Oy.

In distilling the crude tall oil a fine crystalline resin is obtained in addition to the pure oil. These and other products are used extensively in other sections of the Finnish chemical industry. A small part of the cellulose is employed for viscose rayon and viscose wool. Principal firm for rayon is Säteri A.G., of Valkeakoski. Total output of rayon is estimated at 1,000 tons and of viscose wool 5,000 tons.

All the leading chemical firms and research institutes of the country (including those of universities and technical schools) collaborated in 1943 to establish a Chemical Centre (Kämian Keskusliitto-Kemiska Centralverbundet). Its object is to co-ordinate research and chemical industry and to represent Finnish chemical interests both at home and abroad.

Obituary

Sir Holbrook Gaskell

The death occurred on 31 March at his home in London, of SIR HOLBROOK GASKELL, O.B.E., director of the United Alkali Company. Born in 1878, he was educated at Rugby and Trinity College, Cambridge, where he took the Mechanical Science Tripos. After graduating he joined the United Alkali Company as an assistant engineer, becoming chief engineer by 1914. He was elected to the board in 1922 and four years later became managing director. He was knighted in 1942. When Imperial Chemical Industries was formed (of which United Alkali was one of the constituent companies) Sir Holbrook became chairman of the delegate boards of the general chemical and lime groups. He served as a director of I.C.I. from 1934 to 1946.

Mr. T. O. Wilton

MR. THOMAS OWSTON WILTON, who died at his home on 24 March in his 67th year, was managing director of the Chemical Engineering and Wilton's Patent Furnace Co., Ltd. He was educated at Dulwich College and London University. After a period with the London Electric Lighting Co., Mr. Wilton joined The Chemical Engineering Co. in 1917. He was inventor of the continuous process for tar distillation now in use by the company.

New Developments in Fluorine Chemistry

Study of Halogen Fluorides as Possible Reagents

MODERN methods used in the preparation of fluorine, increased knowledge of the technical difficulties encountered in handling this reactive element and research on its academic and industrial applications were discussed by Professor H. J. Emeléus, F.R.S., at a recent meeting in Birmingham held under the auspices of the local section of the Chemical Society and the University Chemical Society. Professor M. Stacey, F.R.S., presided.

Halogen fluorides were the most important and interesting compounds containing fluorine from a purely inorganic standpoint, began the professor, who continued by giving the following list of these substances which have been isolated:—

Halogen Fluorides

Compound	Melting point °C.	Boiling point °C.
ClF	−156	−100
BrF	− 33	20
ClF_3	− 83	12
BrF_3	9	127
BrF_5	− 61	40
IF_5	8	97
IF_7	5	—

With the possible exceptions of bromine trifluoride and iodine pentafluoride, little is known about these compounds; they are all as reactive as elementary fluorine. In every case, they have been prepared directly by treating the halogen with fluorine. By allowing gaseous chlorine and fluorine to react in the correct proportions, either chlorine monofluoride or chlorine trifluoride can be obtained.

Bromine trifluoride is obtained by passing bromine vapour, carried in nitrogen, and fluorine gas through a copper tube at room temperature and freezing out the resulting compound. Elevation of the temperature to 250°C., provides the pentafluoride. When fluorine is passed over iodine, the latter burns with an intense green flame and iodine pentafluoride is formed. Ruff refluxed this substance with excess fluorine in a platinum vessel and obtained the heptafluoride.

Investigation of these substances as possible reagents in preparative chemistry, led to a study of their reactions with the alkali halides. It was thought that bromine trifluoride (BrF_3) and potassium chloride would produce chlorine or chlorine monofluoride. In actual fact potassium fluoride and the halogens are obtained. However, as a side reaction the compound $KF.BrF_3$ can be isolated which loses BrF_3 only when heated to 250°C. This substance is shown to possess its own definite crystal lattice when examined by X-ray powder photographic techniques, and seems to be a salt analogous to substances like $KICl_4$. This material can then be formulated as $KBrF_4$, and, if ionic species are involved, $K^+ BrF^-_4$.

The formation of this substance suggests that the dissociation of liquid BrF_3 into ions can occur:

$$2BrF_3 \rightleftharpoons BrF_2^+ + BrF_4^-.$$

Moreover, the potassium salt is not the only salt of this type which exists. When metallic silver is treated with BrF_3 and the excess gas pumped off under vacuum, the compound, $AgBrF_4$ is formed. Similarly barium fluoride gives $Ba(BrF_4)_2$ providing substantial evidence for the existence of the BrF_4^- anion. Other salts formed with the alkali and alkaline earth metals rapidly lose BrF_3 at room temperature, owing to its high dissociation pressure in these compounds.

If ionisation does occur in these halogen fluorides, then this would be shown by conductivity measurements on the pure liquids. The specific conductances obtained are:—

Compound	*Sp. Conductance, ohm^{-1} cm^{-1}*	
BrF_3	8.0×10^{-8}	(25°C.)
ClF_3	$\sim 10^{-6}$	(0°C.)
IF_5	1.53×10^{-8}	(25°C.)

and definite proof of ionisation in the pure state is obtained.

A measurement of the temperature coefficient of this ionisation for BrF_3 shows a negative value and BrF_3 probably exists only in the covalent form at its boiling point.

In order to follow and understand this ionisation, it is useful to compare it with that of water or ammonia:—

$$2H_2O \rightleftharpoons H_3O^+ + OH^-$$
$$2NH_3 \rightleftharpoons NH_4^+ + NH_2^-$$
$$2BrF_3 \rightleftharpoons BrF_2^+ + BrF_4^-$$

According to modern concepts, the BrF_2^+ cation is the acid and the BrF_4^- anion, the

base; the solvent ionisation equilibrium:

solvent ⇌ acid + base

is then maintained.

Examples of substances with the basic ion have been mentioned; as an example of the acidic ion, antimony trioxide and BrF_3 give $SbBrF_6$, which can be written $BrF_2^+ + SbF_6^-$. This substance, like the base $KBrF_4$, enhances the conductivity of liquid BrF_3, in complete analogy with the conductivity of aqueous salt solutions. Excellent evidence for the existence of these compounds is obtained by conductimetrically titrating one against the other.

In the case of the silver base and the antimony acid, the reaction is:—

$$AgBrF_4 + SbBrF_6 \rightarrow AgSbF_6 + 2BrF_3.$$

base acid salt solvent

and neutralisation is complete at a 1 : 1 ratio of the two substances.

To obtain these products of the neutralisation reaction it is not essential to isolate the parent acids and bases. By reacting metallic silver and antimony oxide with BrF_3, the same product, $AgSbF_6$, is obtained. In this way substances such as $AgAuBrF_4$ and $AgBiBrF_6$ have been formed.

In addition to the stable acids and bases, several unstable ones are recognised by their salt-forming properties in solution. Potassium metaphosphate with BrF_3 gives KPF_6. This reaction proceeds as follows:—

$$K^+ \rightarrow KBrF_4; \quad PO_3^- \rightarrow BrF_2.PF_6$$
$$KBrF_4 + BrF_2.PF_6 \rightarrow KPF_6 + 2BrF_3.$$

Silver arsenate gives $AgAsF_6$ along with $AgBrF_4$; vanadium trichloride, through the intermediate unstable $BrF_2.VF_6$ gives KVF_6. The unstable bases of the alkaline earth and alkali metals mentioned earlier also react in solution; thus the unstable base, $LiBrF_4$, formed from lithium chloride, reacts with with the unstable acid BrF_2VF_6 to give $LiVF_6$.

If liquid nitrogen peroxide is added to BrF_3, an unstable base $NO_2^+ BrF_4^-$ is formed containing the NO_2^+ ion. This base may be titrated with the BrF_2^+ acids.

$$BrF_2SbF_6 + NO_2BrF_4 \rightarrow NO_2SbF_6 + 2BrF_3.$$

Such salts are readily obtained; if gold, NO_2 and BrF_3 are refluxed for a few minutes and excess gases pumped off, the pure compound NO_2AuF_4 is formed. Nitrosyl chloride and nitric oxide give rise to a similar series of compounds containing the NO^+ ion.

Chlorine trifluoride adds to potassium fluoride but no stable compounds are obtained. It is probable that acids and bases of ClF_3 do exist but are much less stable than their BrF_3 analogues. Iodine pentafluoride, however, reacts with potassium fluoride to give KIF_6, and with antimony pentafluoride $ISbF_{10}$, or as conventionally written, the acid, $IF_4^+ SbF_6^-$. Iodine pentafluoride hence ionises as follows:—

$$2IF_5 \rightleftharpoons IF_4^+ + IF_6^-$$

and complete anology with BrF_3, in the acid-base sense, exists. However, BrF_3 provides the best examples of these new inorganic fluorine compounds.

Summer Courses in U.S.A.

SPECIAL courses are announced in the broad programme of summer activities of the Massachusetts Institute of Technology, designed to make its facilities available to technical and scientific personnel not able to take part in regular academic work.

An intensive one-week course on corrosion will be held from 18-23 June under the direction of Professor H. H. Uhlig, who is in charge of the institute's corrosion laboratory. The programme is designed to meet the needs of research directors and plant engineers who wish to review recent trends and developments and will include discussions on the design of equipment, chemical treatment of the environment, cathodic protection, and selection of coatings and alloys economically feasible for reducing corrosion losses.

Designed chiefly for those who wish to investigate the usefulness of infra-red methods in their own research fields, a special course in infra-red spectroscopy will be offered jointly by the spectroscopy laboratory and the department of chemistry. The course will be conducted by Professor Richard C. Lord, director of the spectroscopy laboratory at M.I.T., and Dr. Foil A. Miller, who is in charge of the spectroscopy laboratory at Mellon Institute of Industrial Research.

Two identical one-week programmes beginning 9 July and 16 July will be offered on the techniques and applications of infra-red spectroscopy. Each week's work will be divided equally between lectures and discussions in the morning and the laboratory in the afternoon. Lectures will cover the basic principles of infra-red instrumentation and technique as well as the elementary theory of infra-red absorption by molecules.

Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

7 April 1951

Determination of Tungsten

Part 1—Gravimetric Analytical Methods

THE analytical determination of tungsten in a wide variety of materials is becoming of increasing importance to industry. Each new use of the metal generally necessitates a new or modified method for its estimation. For example, although several hundred such methods have been published in the literature, there is, at the present time, no entirely satisfactory method for the determination of small amounts of tungsten in steels when molybdenum is present. The colorimetric reagent toluene-3,4-dithiol has been a boon to steel chemists in this respect, but special treatment is required to eliminate the interference from molybdenum and the procedure becomes somewhat time-consuming. Of greater value would be a reagent which would precipitate small amounts of tungsten directly and quantitatively in the presence of molybdenum, without precipitating or co-precipitating the latter element. Many reagents have been claimed to precipitate tungsten quantitatively in presence of molybdenum, but stringent tests by numerous analysts have shown that, in the large majority of cases, such a separation does not occur.

In Reasonable Detail

The present review of the various methods available for the determination of tungsten is by no means complete, although all the more important methods have been included; in particular, the developments of the last 10-15 years are described in reasonable detail. Where possible the type of material analysed has been given so that the review may be of value to industrial and analytical chemists engaged in a particular line of research

For the opening up of materials containing tungsten, several well-tried and reliable methods are available. Treatment with single or mixed acids often suffices, and boiling with a 25 per cent w/v solution of potassium hydroxide has been used with success by Hutchin and Fouks[1]. If these procedures are unsatisfactory, then the well-known fluxes—potassium bisulphate, pyrosulphate, hydroxide and carbonate should be tried. Sodium peroxide has been used by Hempel[2] for the decomposition of wolframite.

The Best Procedure

In the analysis of silicates, fusion with alkali carbonates is perhaps the best opening-out procedure, though it must be remembered that in the subsequent leaching of the melt with dilute hydrochloric acid a small amount of tungstic acid will separate out along with silica, which latter must, of course, be removed.

The opening up procedure of Brintzinger and his co-workers[3], who were concerned with the determination of tungsten in ores and slags, is noteworthy. The finely powdered sample is decomposed with sodium sulphide by heating with anhydrous sodium sulphate in a silver boat at 750-850°C. in a current of hydrogen or coal gas.

For purposes of convenience the methods available for the determination of tungsten may be classified under three headings: 1, Gravimetric; 2, Titrimetric; 3, Colorimetric. 'Non-chemical,' *e.g.*, spectrographic, polarographic, procedures will not be described, as it is hoped to include these in a subsequent article dealing with recent developments in the field of instrumental analytical chemistry.

1. *Gravimetric Methods: Organic*

Most gravimetric methods for the determination of tungsten involve the use of organic reagents as precipitants and there is no doubt that future reagents for the metal will be derived from this potentially prolific field. At the present time, the majority of the complexes of organic compounds with tungsten are of indefinite composition, with the result that the precipitate must be ignited to tungstic oxide, WO_3, as the final weighing form. As the conversion factor for W is

unfavourable in this case, an organic reagent which would form a complex of definite composition with tungsten, and which would concomitantly provide a favourable conversion factor for the element, would be of inestimable value to analytical chemists, more especially where milligram quantities of tungsten are concerned.

Precipitation with Cinchonine

Lefort[4] first described the use of quinine acetate for the gravimetric determination of tungsten. This has not met with favour, but the related compound cinchonine, suggested by Cremer[5] and first employed by Low[6], has achieved widespread popularity.

Digestion of a solution of tungstic acid with a mixture of hydrochloric and nitric acids will normally remove all but the last traces of tungsten from solution. When alkali salts are present, however, there is a tendency for acid tungstates, *e.g.*, $Na_2W_4O_{13}$, to be formed, which are not readily decomposed by acids. Cinchonine is claimed by many workers to prevent formation of these acid tungstates, and to flocculate the last traces of tungsten. Box[7] and Lambie[8], however, state that cinchonine will not do this, nor will rhodamine B, although Box preferred rhodamine B to cinchonine. Lambie prefers the well-known tannin method of Schoeller and Gahn[9]. Simpson *et al.*[10] obtained good results with cinchonine, but their results were inconsistent in presence of phosphate, due probably to the formation of cinchonine phosphotungstate, which on ignition gives $P_2O_5.24WO_3$.

Holliday[11] used cinchonine for the determination of tungsten in ores, and Wilson and Fields[12] have used it with success for the determination of tungsten in rocks. Rohm[13] described a rapid method for the determination of tungsten in steels based on the use of cinchonine as reagent, while Gerka and Kardakova[14] have determined tungsten in hard alloys of the stellite type using a similar procedure.

A recent paper by Furey and Cunningham[15] details methods for the analysis of simple and complex tungsten carbides. After the preliminary opening-out of the material with a sodium peroxide fusion, the tungsten in the leachings was satisfactorily determined using cinchonine and α-benzoin oxime as precipitants.

More recently, Lambie[16] investigated methods for the separation of tungsten from arsenic. He found that the most accurate results could be obtained using a tannin-antipyrine method, but confirmed his earlier findings that the precipitation of tungsten from acid solution with cinchonine gave low results.

Gusev and Kumov[17] found that tungsten in alloys could be determined satisfactorily using either cinchonine or pyramidone as precipitants from saturated oxalic acid and 30 per cent hydrogen peroxide solutions. The work of Pinto[18] is worthy of mention. He compared the cinchonine, tannin-antipyrine, and cinchonine-tannin-antipyrine precipitation methods and found that all three gave similar results on samples of Scheelite containing 73-75.5 per cent and 0-0.3 per cent of tungsten.

Liang and Chang[19] carried out a thorough examination of cinchonine, brucine, quinine, strychnine and codeine as tungsten precipitants and claimed complete precipitation of tungsten from solutions which were 0.2N with respect to hydrochloric acid.

Myers *et al.*[20] determined tungsten in tantalum-rich alloys containing molybdenum, and claimed satisfactory recoveries. Their method is briefly as follows: The sample (containing less than 0.02 g. of WO_3) is dissolved in hydrofluoric and nitric acids, a little sulphuric acid added and the solution taken to dryness. The residue is broken up and fused with potassium carbonate. Addition of magnesium sulphate then separates magnesium tantalate from potassium tungstate and potassium tantalate. The tungstate is then determined by the tannin-cinchonine method.

Alternative Methods

In view of the conflicting evidence regarding the completeness of precipitation with cinchonine, it is not surprising that chemists have turned to alternative methods for determining tungsten. Another disadvantage of the cinchonine method is that considerable co-precipitation of molybdenum generally occurs, with the result that a re-fusion followed by a re-precipitation is often necessary. There is no doubt also that, while co-precipitation of molybdenum is eliminated at high acid concentrations (c.a. 1N), the amount of tungsten remaining in solution is increased.

The method of Brintzinger *et al.*[21] is of interest in that only nitric acid is used as precipitant. In this procedure tungsten was determined in ores and slags by nitric acid precipitation of tungstic acid from a solution containing ammonium chloride. However,

only large amounts of tungsten may be determined satisfactorily by this method.

Jaboulay[22] has determined tungsten in high speed steels by precipitation with hydrochloric acid, after digestion of the sample with a mixture of nitric and hydrochloric acids. The residue, however, is badly contaminated, and a fusion with pyrosulphate followed by a re-precipitation is necessary to remove impurities. Although the paper has only been seen in abstract, it is difficult to comprehend how the last traces of tungsten can be brought down by the procedure described, in view of the findings of countless other workers.

The use of 0.1 per cent gelatine solution in place of cinchonine is claimed by Tananaev and Lotsmanova[23] to promote the quantitative separation of tungstic acid from solution, and the procedure has been satisfactorily applied to the determination of tungsten in steels.

The work of Feigl[24] is of importance. He showed that acid fluoride solution seriously interferes with all precipitation reactions of the tungstate ion including the precipitation with cinchonine. Budanova and Gavrilova[25] have actually used this masking effect of the fluoride ion to separate columbium from tungsten.

(To be continued)

REFERENCES

[1] *Trans. Inst. Min. Met., 18,* 425 (1909).
[2] *Z. anorg. Chem. 3,* 193 (1895).
[3] *Ibid. 255,* 323 (1948).
[4] *Compt. Rend., 92,* 1461 (1881).
[5] *Eng. Min. J., 59,* 345 (1895).
[6] *Ibid., 106,* 27 (1918).
[7] *Analyst, 69,* 272 (1944).
[8] *Ibid., 68,* 481 (1939).
[9] *C.A., 21,* 3854.
[10] *Ind. Eng. Chem. (Anal. Ed.) 10,* 243 (1938).
[11] Treadwell and Hall, *Analytical Chemistry,* Vol. II, p.270, Wiley, N.Y. (1930).
[12] *Analyst, 69,* 12 (1944).
[13] *Chem. Met. Eng. 25,* 1060 (1922).
[14] *Chimie et Industrie, 39,* 80.
[15] *Anal. Chem. 20,* 563 (1948).
[16] *Analyst, 74,* 405 (1949).
[17] *Zhur. Anal. Chim., 4,* 175 (1949).
[18] *Anais. assoc. quim. Brasil. 7,* 65 (1948).
[19] *Science Record, 2, 295,* (1949).
[20] *Metallurgia, 42,* 8 (1950).
[21] *Z. anorg. Chem., 255,* 323 (1948).
[22] *Rev. Met., 47,* 53 (1950).
[23] *Zhur. Anal. Chim., 1,* 206 (1946).
[24] *Anal. Chim. Acta, 2,* 397 (1948).
[25] *Zav. Lab., 15,* 7 (1949).

Titanium in Steel Enamelling

The cost of enamelling steel can be greatly reduced if a small quantity of titanium is added to the steel, Dr. Edward E. Marbaker, senior fellow at the Mellon Institute, Pittsburgh, Pennsylvania, reported at the annual technical conference of the American Chemical Society's Philadelphia Section. Ordinarily the coating of sheet steel requires two kinds of enamel—a ground coat, which clings tightly to the metal, and a cover coat, which produces the desired colour, gloss and resistance to abrasion and chemical attack—Dr. Marbaker pointed out. Noting that much scientific research has been expended on the problem of providing steel well adapted to the enamelling process, he said: 'The most recent improvement in steel for enamelling is based on the discovery that the presence of a small quantity of titanium in the steel makes possible, with a carefully controlled nickel flash on the surface, direct enamelling with the cover coat. Thus the material and operating costs of a ground coat are eliminated.'

One Minute Alloy Analysis

AN automatic photo-electric instrument capable of obtaining the complete chemical analysis of an aluminium alloy in less than one minute, and producing a written analytical report in duplicate, was described recently by Mr. J. R. Churchill, assistant chief of the analytical division of the Aluminium Company of America. The instrument, called a quantometer, is able to provide a true control analysis, in as much as analysis can be performed, while the aluminium is being processed, and concentrational adjustments can be made immediately if the product does not meet specifications, Mr. Churchill stated. Where high uniformity of product is required to meet the exacting needs of such customers as the aircraft industry, the automatic instrument produces faster, less expensive and more reliable test results than those obtained by laboratory technicians, it was explained. Six million analytical determinations a year on metal samples alone are required in the operations of the Aluminium Company of America, and the fact that half of these analyses are now made by automatic quantometers results in a tremendous saving of time.

Shipping for Sulphur

A British cargo vessel (9,000 tons dead weight), which was to have carried American coal to Denmark, has been released to enable her to load a cargo of sulphur for the United Kingdom, at Port Sulphur, Gulf of Mexico, this month.

Nickel's Usefulness To-day

Canadian Industry's Share in Development

THE year 1951 marks the 200th anniversary of the discovery of nickel by the Swedish scientist Cronstedt. Until the beginning of the 20th century—in fact, well into this century—nickel was little appreciated and less sought after. To geologists, it was a metal which is twice as abundant in the earth's crust as copper, zinc and lead combined. To civilisation, until comparatively recent times, it might just as well not have existed.

Progressive Increase

Nickel's usefulness to-day is due primarily to the Canadian nickel industry, in which the International Nickel Company of Canada, Ltd., has played a prominent part. In his report for the year ended 31 December, 1950, Dr. John F. Thompson, chairman and president, graphically presented the progressive increases over the past 30 years in the supply of nickel resulting from the company's long-range production plans.

During the year under review International Nickel delivered 256,410,543 lb. of nickel in all forms, which was more than in any peace-time year. Deliveries of special rolling mill products produced in the U.S.A. and the United Kingdom also established a new record. In addition to increasing deliveries of nickel over 1949 by 22 per cent and delivering 267,316 oz. of platinium metals, an increase of 24 per cent over 1949, it delivered 212,947,394 lb. of refined copper, and also gold, silver, selenium, tellurium and cobalt.

To provide this expanded supply of nickel, the company brought into operation an additional blast furnace at its Coniston smelter and an additional reverberatory furnace at its Copper Cliff smelter. With the outbreak of hostilities in Korea, the extensive programme under way for providing new underground mining capacity was supplemented by an emergency project to provide quickly temporary greater capacity at the mines, concentrating mills and smelters.

Further, to assure continuity of nickel supplies, the search for ore was accelerated and intensified. In 1950, some 24,000 sq. mls. of area were prospected chiefly by air, and detailed surveys made of 3,215 sq. mls. The depth of exploration drilling during the year was 260,127 ft., equivalent to a total depth of fifty miles. At the same time, mining processes and metallurgical operations were improved.

The report discloses that 'research involving pilot plant effort continued to be devoted to the greater utilisation of ores through the production of iron ore and sulphur dioxide. This work was encouraging not only from the standpoint of by-products recovery but also had major significance from the standpoint of simplifying smelter process metallurgy.'

In connection with its research looking for better nickel products and new uses for them, work was intensified on the high temperature properties of metals required in jet planes; a construction programme was completed at the Bayonne, N.J., Laboratory, and the new Harbor Island Marine Corrosion Laboratory at Wrightsville, N.C., was finished.

Together with a station at Kure Beach, N.C., where 20,000 specimens are currently being subjected to tests, this laboratory conducts research into corrosion of alloys in salt water and sea air.

Light Metal Statistics

PRODUCTION, imports and consumption of light metals in 1950 and for the last month of that year revealed by the Ministry of Supply included the following (in long tons):—

	December	Total for Year, 1950
Virgin aluminium		
Production	2,508	29,468
Imports	15,243	141,974
Secondary aluminium		
Production	6,448	86,372
Aluminium Scrap Arisings		
Arisings	6,962	92,756
Consumption	8,012	118,464
Aluminium Fabrication—Wrought Products		
Sheet and strip	11,508	121,665
Extrusions	4,058	44,333
Forgings	329	3,761
Castings	4,949	57,516
Total fabricated (excluding forging bar)	20,844	227,275
Foil	967	11,116
Magnesium Fabrication	336	3,763

Future Demand for Metallurgists

Some Shortage in Industry Expected

THAT the supply of qualified metallurgists during the next five years will be inadequate to satisfy the demand, particularly in those sections of industry dealing with production and development, is the conclusion of the report made to the Minister of Labour and National Service by the Metallurgists' sub-committee appointed by the Technical Personnel Committee.

The inquiry began in October, 1949, and relates to the five-year period ending 1954, beyond which time it was not considered practicable to make any forecast.

Estimating possible demand was found to be one of greater difficulty than in some other cases, as for the most part metallurgists are employed in small numbers by a wide range of firms in many different industries. Appreciation was expressed of the co-operation given by a large number of organisations which are listed as an appendix to the report.

The University Grants Committee supplied estimates of the numbers of persons expected to obtain either pass degrees or degrees with honours in metallurgy each year in the immediate future. These estimates naturally become more uncertain as the year for which they are made becomes more distant. A consideration of the figures given, however, led to the conclusion that something approaching 1,000 metallurgists qualified with at least a pass degree would be available from the universities during the period 1950-1954.

Qualified Metallurgist Class

During the above period, there would be a number of individuals who, although not at a university, would enter the class of 'qualified metallurgist', either by taking the London University External Degree, or by being admitted to membership of the Institution of Metallurgists or the Institution of Mining and Metallurgy (generally after whole or part time study in a technical college).

The number expected to qualify each year in this way during the five years covered by the inquiry was small, but as it was liable to fluctuate to a considerable extent, it was not possible to arrive at any precise figure. The total 'supply' between 1950 and 1954, including the university graduates referred to above, was estimated at around 1,150. With relatively slight variation the number available each year should be the same.

The metallurgists engaged in industry fall broadly into two main groups, those employed by firms producing and fabricating metals and alloys and those in the service of engineering chemical and other firms using metals and alloys.

Total Requirements

In education it was estimated that during the period under review there would be a total demand for the universities of about 40, some 30 of which would be for new posts. Total requirements for metallurgists for teaching posts in technical colleges according to the Ministry of Education and the Scottish Education Department numbered sixty.

In Government service the demand for metallurgists was estimated at 170 for the next five years.

Demand for overseas employment comes mainly from metalliferous mining and metal extracting companies. These recruited personnel not only from the United Kingdom but also from the Commonwealth countries so that an estimate of future demands was more difficult. Past experience, however, showed the number of new graduates taking up overseas posts as about 10 each year, so that 50 would probably satisfy the demand for the period to 1954.

Estimated demands allowed for expansion and replacement of wastage on the assumption that (as in the Barlow report on Scientific Manpower) the average professional life of a scientist is 30 years. The total demand, therefore, was computed to be 1,350 for the five-year period.

Although the overall shortage was not found to be great, it was most likely to be felt in industry, whereas the supply for teaching and research might be more than sufficient.

Several firms expressed the view that the majority of students were lacking in workshop and engineering background and that additional training, sometimes for two years or more, was necessary before the new employee became really useful.

If a career in industrial production is contemplated, it is suggested that students should be encouraged either to leave college after graduation or to spend any further time in college in studies more helpful to their future work than those now generally considered necessary for honours degree preparation.

Such steps, by shortening the time between entering college and becoming fully useful in industry, would help to accelerate the supply in the immediate future. It has been suggested that such arrangements as those made by Birmingham University in its Department of Industrial Metallurgy to provide courses specially suited for those going into industry might be adopted more widely.

The future supply situation would also be helped by more general readiness on the part of industry to engage graduates without 'Honours' who are suited by temperament and personality for an industrial career outside the laboratory; men so engaged would complete their industrial training on the job.

Active and urgent consideration should be given by those concerned to the question of whether the training of metallurgists intending to enter industry is best suited to the needs of the time, while efforts should be continued to interest school teachers and scholars in the possibilities of a career in metallurgy.

The committee met under the chairmanship of Sir William Griffiths, then chairman of the Mond Nickel Co., Ltd., and was composed of the following members: Professor C. W. Donnatt (Royal School of Mines); Sir Andrew McCance (Colvilles, Ltd.); Mrs. Robson (Imperial Smelting Corporation); Mr. H. F. Rosetti (Ministry of Labour and National Service); Sir Arthur Smout (I.C.I. Metals, Ltd.); Dr. A. E. Trueman (University Grants Committee); Professor W. Wardlaw (Ministry of Labour and National Service) and secretary, Mr. C. A. Hankey (Ministry of Labour and Natoinal Service).

U.S.A. Manganese Recovery

New Economic Method Described

AN economical method of refining low-grade manganese ore which, if properly exploited, might satisfy the demands of the United States for more than 100 years was described recently to the American Chemical Society's North Jersey Section by Dr. E. S. Nossen, director of research of E. S. Nossen Laboratories, Inc., Paterson, New Jersey.

Thirteen pounds of manganese are required in every ton of steel, Dr. Nossen pointed out, and it cannot be replaced by any other metal. Manganese is therefore a highly strategic material. Hundreds of millions of tons of manganese-containing ores are available in the United States, he said, but in the past up to 90 per cent of the nation's needs have been met by imports.

The process reported by Dr. Nossen involves converting manganese ores to manganese monoxide and then dissolving the material in nitric acid. The nitric acid cycle, which was developed at the Nossen Laboratories, permits the acid to be recovered and re-used, thus making economical operation possible, it was said.

Discussing the disadvantages of various methods by which manganese ores are now processed, he told how the nitric acid method avoids their limitations. The process is applicable to both oxide and carbonate ores, the two kinds most prevalent in the United States, he said, adding that it appeared to be very advantageous in ores with a high iron content such as those of the Cujuna range in Minnesota, because a large amount of the iron is recovered. 'What with other processes was an expensive nuisance turns out to help the economy of this process by lowering the cost of the manganese,' the speaker said. The major steps of the process are very simple and do not require any special equipment or complicated or unusual operating conditions, such as high pressures and high temperatures.

Scrap and Sulphuric Acid Prices

The Ministry of Supply has made a new Order bringing the maximum prices of non-ferrous scrap into line with the new selling prices of virgin copper, lead and zinc. The Order—The Non-Ferrous Metals Prices (No. 3) Order S.I. 1951 No. 550—came into effect on 4 April.

The Board of Trade have made an Order, coming into effect on 9 April, permitting increases in the maximum prices of sulphuric acid, due mainly to the advances in the world prices of sulphur and pyrites and of freight rates. The additions to maximum prices are 26s. 6d. per ton on weak acid (77 per cent H_2SO_4) and 33s. 9d. per ton on strong acid (more than 84.02 per cent H_2SO_4).

Increase in Chemical Prices

FOLLOWING the rise in the price of ethyl alcohol, British Industrial Solvents, Ltd., announce that it has been found necessary to increase correspondingly the prices of a large number of chemicals which are derived from alcohol.

Taking effect on all deliveries made after 1 April, 1951, the new prices of the main alcohol derivatives are as follows:—

	Per ton
ACETIC ACID	
98 per cent glacial commercial	£129 (a)
80 per cent pure	£115 (a)
80 per cent technical	£109 (a)
ACETIC ANHYDRIDE	£165 (a)
BUTYL ALCOHOL	£250 (b)
ACETATES	
Ethyl acetate	£174 (b)
Isopropyl acetate	£148 (b)
Butyl acetate	£263 (b)
Amyl acetate, technical	£310 (b)
PHTHALATES	Per lb.
Diethyl phthalate	2s. 2½ (c)
Dibutyl phthalate	2s. 7½ (c)

(a) 10 tons, spot or contract over calendar year, carriage paid in returnable packages.
(b) 10 tons, spot or contract over six months, carriage paid in returnable packages.
(c) 5 tons spot or contract over six months, carriage paid in returnable packages.

Owing to the increased price of molasses from which alcohol, the starting point of many of its products is derived, A. Boake, Roberts & Co., Ltd., announced that as from 2 April many of its prices will have to be raised.

Among the major increases in the revised price schedule are:—acetic acid-technical £41, 100 per cent grades £51 per ton; amyl alcohol, technical, £105 per ton; pure benzyl acetate 4d. per lb.; bornyl acetate 6d. per lb.; butyl acetate £106 10s. per ton; catechol 4s. per lb.; ethyl acetate £60 per ton; ethyl aceto acetate 1s. per lb.; ethyl benzoate 3d. per lb.; ethyl formate £55 per ton; methyl acetate £42 per ton; methyl acetone £13 per ton; isopropyl acetate £42 10s. per ton; sodium acetate powder £41 per ton; tannic acid B.P. 9d. per lb.

New prices announced by the Distillers Co., Ltd., are as follows:—

PLAIN BRITISH SPIRIT

	Per proof gallon
Ethyl alcohol .. 95 per cent Gay Lussac 66.0 o.p.	s. d.

Proof gallons

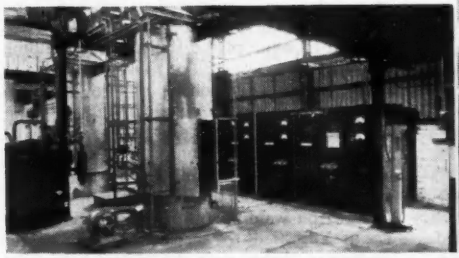
Over 300,000	4 5½
200,000 and less than 300,000	4 6
100,000 " " 200,000	4 6½
50,000 " " 100,000	4 7
10,000 " " 50,000	4 7½
2,500 " " 10,000	4 8½

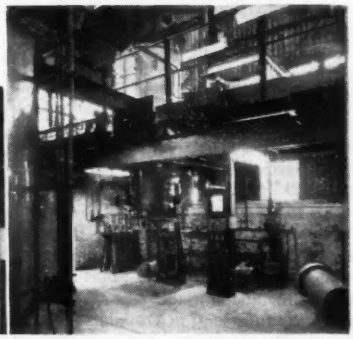
The following special grades of ethyl alcohol are subject to a premium on the above prices:—

	Premium Per proof gallon
Absolute alcohol—99.5 per cent 74.5 o.p.	1d.
Absolute alcohol—Special high strength 99.9 per cent 75.2 o.p.	3d.
Doubly rectified alcohol (S.V.R.)—95.8 per cent 68 o.p.	2d.
P.I. rectified alcohol—96.1 per cent 68.5 o.p.	6d.
R.R. absolute alcohol—absolute alcohol re-rectified 99.7 per cent 75 o.p.	14s.
Per bulk gallon (nett)	

The Methylating Co., Ltd., announce that the prices of methylated and other denatured spirits have been adjusted accordingly.

Zirconium Plant





As recently announced (see CHEMICAL AGE, page 306, 24 February, 1951), the production of zirconium on a commercial scale has been initiated by Murex Limited, Rainham, Essex, and the above photographs were taken in this firm's factory

Synthetic Fuels Research

Japanese Efforts Failed Disastrously

FACED with meagre petroleum resources and a large demand for fuels and lubricants for their mechanised military equipment, the Japanese during World War II attempted, with little success, to make petrol and oil not only from coal, but from such materials as orange peels, rubber, and pine needles.

Failed Disastrously

Although plants for producing synthetic liquid fuels were built and operated, according to a new report on Japanese research just released by the U.S. Bureau of Mines, the plants failed disastrously to bridge the gap between the supply of petroleum products and the demands of the Japanese war machine. Peak annual production was achieved in 1944 and totalled 955,000 barrels. The bulk of this total, 899,970 barrels, was produced by low-temperature carbonisation of coal, a process yielding coke or char as the main product and liquid fuel as a by-product. In the same year, coal hydrogenation, which had been studied more intensively in Japan than in any other country except Great Britain and Germany, yielded only 5,780 barrels, and plants using the Fischer-Tropsch or gas-synthesis process produced 149,250 barrels.

Failure to attain more favourable results is attributed largely to the by-passing of necessary laboratory and pilot-plant research before attempting production on a commercial scale.

The highly technical 41-page report, presenting an insight into Japanese research methods and progress in the synthesis of liquid fuels, discusses pilot-plant equipment used and gives detailed descriptions of various plant units, including the desulphuriser, converter and condenser. Engineering sketches and photographs of apparatus discussed in the text as well as plant flow-sheets are also included in the report. Copies of the report, Information Circular 7593, titled 'Process Development in the Hydrocarbon Synthesis,' may be obtained free of charge from the Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Street, Pittsburgh 13, Pennsylvania.

To Control Magnesium

IN order to meet growing defence needs steps are being taken by the Ministry of Supply to control supplies and increase production of magnesium.

Responsibility for the supply and distribution of all virgin magnesium in the United Kingdom will be assumed by the Minister of Supply (Mr. G. R. Strauss) as from 1 May.

To enable the Ministry to assess the requirements of industry consumers of virgin magnesium will be required to provide information of stocks at 31 March, consumption during the first quarter of 1951 and estimated requirements in April and May.

Magnesium was extracted from sea water and produced domestically during the war at a price which was not then economic, compared with imported values. The cost of extraction from sea water does not now, however, vary greatly from that of imported metal.

A plant, near Manchester, closed after the war, is to be re-opened by the Ministry and will process magnesia obtained from sea water by a plant at West Hartlepool.

Welding Summer School

WELDING design and engineering will be the subjects of a summer school organised by the British Welding Research Association to be held at Ashorne Hill, near Leamington Spa, Warwickshire, from 25 May to 2 June. The aims are to acquaint the practical man with up-to-date welding developments; to stimulate the application of experimental knowledge and experience in industry; and to describe the present state of knowledge relating to some of the fundamental welding problems.

The course will consist of two introductory days devoted to developments in welding practice and metallurgical aspects of welding ferrous and non-ferrous metals.

During the remaining days, morning sessions will be concerned with general lectures on welding problems and the afternoons allocated to specialised talks, with particular attention to the plastic behaviour of welded structures and the stresses in and design of pressure vessels and pipelines.

Evening discussions will also be held on topics of importance to welding engineers.

Technical Publications

IMPROVEMENT in the durability of surfacings and reduction in the cost of constructional processes was the main object of the programme of research into bituminous road materials carried out by the Road Research Laboratory in 1949. Two laboratory-scale methods were developed during the year for removing from road tars the phenolic contents which are largely responsible for the susceptibility of tars to the effects of oxidation. Full-scale experiments were also made in the use of a creosote solution of cetyl pyridinium bromide to assist the adhesion of surface-dressings in wet weather. A summary of progress in materials and methods of construction and road safety and traffic flow is given in 'Road Research, 1949' (HMSO, 3s. 6d.) second of the post-war annual reports of the Road Research Laboratory with which is published the report of the Road Research Board.

WATER pollution is the subject of a considerable volume of literature, and a useful service is performed by the DSIR which publishes monthly a list of abstracts prepared by its Water Pollution Research staff. Latest abstracts available (HMSO, 2s. each), are March (Nos. 249-359); April (360-509); May (510-647); June (648-773); July (774-901); August (902-1031), all in Vol. 23, 1950, and the index to Vol. 22, 1949.

COBALT and other metals used as driers in the paint and allied industries are the subject of a booklet by H. Houlston Morgan, Ph.D., A.R.C.S., F.R.I.C., past-president of the Oil and Colour Chemists' Association, which is now obtainable from the Mond Nickel Co., Ltd. The new publication covers the drying process, the use of driers, soluble and liquid driers, mechanism of drier action, relative merits of individual driers, the effect of various other metals on the drying process and the effect of pigmentation. Typical analyses of cobalt salts are also given.

PHOTO-ELECTRIC CELLS have been much developed in recent years, but there has, unfortunately, been a tendency in the popular Press to over-estimate their importance, while in some instances they have been unwisely exploited by instrument makers. The uses of varying types of photo-electric cell, how they are made, how they work and their applications in industry are described for the non-technical reader in a booklet 'Electric Eyes,' by A. J. Fawcett, just published by The Tintometer, Ltd., Milford, Salisbury (1s. 6d.). Shortcomings and disadvantages of the cell are fairly set out, particularly in the field of colorimetry in which its functions and limitations are most misunderstood.

PETROLEUM sulphonates and sulphuric acids, their industrial applications, formation and physico-chemical characteristics are described by F. W. Longbottom, B.Sc., A.F.Inst.Pet. in 'Oil' (Vol. 1, No. 10), the journal of the Manchester Oil Refinery Group of Companies. Other features include 'Mineral Oils in the Baking Industry' by M. A. Cookson, B.Sc., A.R.I.C.; the importance of on-the-site welding and pipe-bending to oil refineries; and the development of Flexibox mechanical seals, reviewing their value in the oil refining and chemical industries.

GAS COKE is the subject of the second series of reviews on smokeless fuels being published in 'Smokeless Air,' journal of the National Smoke Abatement Society. Other features of the spring issue (Vol. xxi, No. 77) include a survey of the Fuel Efficiency Exhibition held in Manchester and an article on the formation of new local consultative committees for joint discussion on methods of reducing air pollution.

ADVANTAGES of nickel-molybdenum and nickel-molybdenum-chromium alloys for the construction of numerous items of chemical plant are set out in a paper by W. H. Richardson, B.Sc., A.I.M., chief metallurgist, Langley Alloys, Ltd., now available from the company. Corrosion-resistance of these materials to mineral acids, organic acids, alkalis, salt solutions and gases is described. In the industrial applications it is shown how Langalloys 4R and 5R are being increasingly used by chemical and petroleum industries in the form of pump bodies, impellers, pipe fittings, valves and valve trim to give excellent service in handling strong mineral acids, strongly oxidising solutions and many organic substances.

IN THE EDITOR'S POST

Indian Fertiliser Production

SIR,—In the article in THE CHEMICAL AGE dated 30 December 1950 on World Production of Fertilisers, with respect to the progress made in India during the last five years and the programmes for the next few years, you have omitted mentioning the contribution made by one of the important projects completed after the survey in 1944 was done.

In 1947 a factory for the manufacture of ammonium sulphate with an annual capacity of 50,000 tons went into production at Travancore, South India. This uses wood as fuel for manufacture of ammonia synthesis gases, and locally procurable gypsum for sulphate production. Sulphate is also produced from sulphuric acid using imported sulphur. In 1948, production of superphosphate was commenced and equipments for an annual capacity of 36,000 tons have been completed in 1950. This factory contributed 26,000 tons of ammonium sulphate and 11,000 tons of superphosphate in 1949 and 25,700 tons of ammonium sulphate and 6,500 tons of superphosphate in 1950.

Production in this factory has received a set-back due to the international shortage of sulphur as the production of superphosphate and 50 per cent of the sulphate is based on acid from imported sulphur. Alternate sources of sulphuric acid production are being explored.

Travancore. P. K. SESHAN.

Society of Leather Trades' Chemists

The provisional programme is announced for the London conference of the International Union of Leather Chemist Societies, to be held from 9-14 September. Proceedings will begin with a reception of delegates by the president, Mr. J. R. Blockey, at the Mayfair Hotel. The conference, to be held at the Portland Hall annexe, Regent Street, Polytechnic, will be officially opened by the Lord Mayor of London at 11 o'clock on 10 September. A number of scientific papers will be read. The laboratories of the British Leather Manufacturers' Research Association will be visited on the morning of 12 September, and there will be a banquet at the Park Lane Hotel on the evening of the following day. The annual general meeting of the Society of Leather Trades' Chemists will be held on the morning of the 14th.

Next Week's Events

MONDAY 9 APRIL

The Chemical Society

Galway: University College, 7.45 p.m. Professor John Read: 'Humour and Humanism in Chemistry.'

Institute of Fuel

Newcastle: King's College, 6.30 p.m. J. Diamond: 'Atomic Energy.'

TUESDAY 10 APRIL

Society of Instrument Technology

Manchester: College of Technology, 7.30 p.m. A. D. E. Lauchlan: '*p*H Measurement.'

Chemical Engineering Group (SCI)

London: Burlington House, W.1, 5.30 p.m. M. W. Goldblatt: 'Man and the Chemical Industry: A Consideration of Physiological Adaptability.'

WEDNESDAY 11 APRIL

Society of Chemical Industry (Food Group)

London: Burlington House, W.1, 6.30 p.m. Annual General Meeting. Address by A. L. Bacharach: 'The Man of Taste.'

THURSDAY 12 APRIL

Institute of Fuel

Nottingham: Gas Showrooms, 6.15 p.m. C. A. Masterman: 'Underground Gasification.'

FRIDAY 13 APRIL

The Chemical Society

St. Andrews: Chemistry Department, United College, 5.15 p.m. A. L. Bacharach: 'Laboratory Animals: Their Uses and Productions.'

British Standards Exhibition

This year the British Standards movement attains its Golden Jubilee, and as a part of the celebrations an exhibition, supported by practically the whole range of British industry will be held at the Science Museum, South Kensington, during the two weeks beginning 18 June, 1951. The benefits derived from standards, standardisation and simplification will be graphically presented, and each industry will show how standards have simplified production, reduced costs and maintained quality, and how in turn they have benefited the users of that industry's products. The exhibition will also show how research at one end of the production chain, and quality control at the other, are linked with and helped by standardisation.

The Chemist's Bookshelf

CHEMICAL ANALYSIS OF CAST IRON AND FOUNDRY MATERIALS. By W. Westwood and A. Mayer. London: Allen & Unwin, Ltd. March, 1951. Pp. 565. 42s.

This book, one of the series 'Manuals on Foundry Technology,' edited by J. G. Pearce, will serve both the research chemist and the routine analyst. It deals with the chemical analysis of all metals encountered in modern iron foundry practice. The authors through their experiences with the British Cast Iron Research Association and other industrial research organisations had ample opportunity for studying, developing and improving the methods employed in ferrous metallurgical analysis and are thus authorised to write this comprehensive treatise on a subject which is attracting more and more practical aspects by the impacts of science on foundry practice.

The book presents the analytical procedures in such a manner that the determinations can be carried out readily by assistants having no special chemical training. The method of determination of 25 elements, dealt with in alphabetical order, is prefaced by a survey of available methods, with extensive references to the most recent work, and followed by theoretical considerations. Practical hints, time required, methods of calculation, range and accuracy, are given for each method.

The book, divided into nine chapters, opens with a general introduction to chemical practice, then examines the sampling and analysis of iron, ferro-alloys, iron-ore, slags, silica, coal and coke, and the analysis of coal and coke ash. Methods of determination for metals and ferro-alloys, which pay particular attention to the determination of small amounts of alloying elements, are carefully explained. Finally, the book gives the very necessary routine chemical tests on oils and binders. An appendix of useful tables, 32 figures and a list of standard works of reference are included. While the authors stress the theoretical considerations, they always point to the practical, a field nearly all segments of industry are concerned with, and in which great headway has already been made and should be still further accomplished in the not too distant future.—F.N.

STANDARD METHODS OF ANALYSIS OF IRON, STEEL AND FERRO-ALLOYS. The United Steel Companies Limited, Sheffield. 1951. Pp. xv + 170. Price 17s. 6d.

The present fourth edition of this outstanding compilation considers the rapid development in methods and technique of chemical analysis during the five years that have elapsed since the third edition (1945). The major addition is a new section dealing with physico-chemical techniques, such as absorptiometric and polarographic methods, which have proved of great value in practice. All the methods described are selected methods actually in use in the laboratories of the United Steel Companies Ltd., and recommended by five fully active working sub-committees of the British Iron and Steel Research Association.

The text is divided into the following four chapters: Analysis of iron and steel (23 methods); Special analytical methods and absorptiometric methods (10); Analysis of ferro-alloys (8), while part IV deals with fluorspar. An appendix concerns a table of atomic weights, based on the 1946-47 List of Atomic Weights, amended by the recent recommendations of the International Union of Pure and Applied Chemistry.

Most sections of industry are today concerned with the subject of iron and steel and therefore this treatise should prove most valuable to chemists, engineers, metallurgists, research experts and students, etc., concerned with the subject, and should contribute substantially to the industrial and commercial interest in the analysis and valuation of iron, steel and ferro-alloys.—F.N.

HOME

Plastics and Polymer Group

The nineteenth annual general meeting of the Plastics and Polymer Group of the Society of Chemical Industry is being held on 25 April in the Connaught Rooms at 6.30 p.m., followed by an informal group dinner. The chairman appointed for the 1951/2 session is Mr. G. Dring.

Chemical Society Research Fund

The Research Fund of the Chemical Society provides grants for the assistance of research in all branches of chemistry. About £700 per annum is available for this purpose, the income being derived from a donation of the Worshipful Company of Goldsmiths, from the Perkin Memorial Fund, and from other sources. Applications for grants will be considered in November next and should be submitted on the appropriate form not later than Tuesday, 1 May, 1951. Applications from Fellows will receive prior consideration. Forms of application, together with the regulations governing the award of grants, may be obtained from the General Secretary, The Chemical Society, Burlington House, Piccadilly, London, W.1.

Polarography Meeting

The Physical Methods Group of the Society of Public Analysts will hold a meeting at the Iron and Steel Institute's Meeting Rooms on 10 April at 6.30 p.m. to discuss polarography. The papers to be read will include: 'Vibrating electrodes in polarography—the effect of frequency and amplitude of vibration on diffusion current'; 'The polarographic behaviour of iodo-organic compounds'; and 'Selected applications of polarography in inorganic analysis.' The first paper will discuss the advantages of vibrating electrodes over rotating ones and the use of platinum micro-electrodes; the second will mention the use of polarography for estimating thyroxine and pheniodol labelled with radioactive iodine, and the third will include the determination of very small amounts of indium in beryllium compounds and of trace elements in pure tin, white metals and other non-ferrous alloys. There will be an open discussion after the papers. The next meeting on 22 May will be on radiochemical analysis.

Large Coal Drying Plant

The British Electricity Authority have placed an order for coal drying plant with the British Rema Manufacturing Co., Ltd., subsidiary of Edgar Allen and Co., Ltd., Imperial Steel Works, Sheffield 9. The contract, which is of a value in excess of £100,000, covers the complete supply of the plant with buildings and auxiliaries, at Tir Power Station, Swansea. Anthracite duff and steam duff will be dealt with at the rate of 100 tons per hour, in four British Rema rapid pneumatic dryers. These large plants receive wet fuel which is dried automatically in less than one minute.

Penicillin Output Increasing

Glaxo Laboratories announce that output of penicillin from their Barnard Castle, Durham, plant has increased over 70 per cent in the last three months. They attribute this largely to greater fermentation capacity, improved cultures for inoculating the tanks, and improved extraction technique, as well as to faster packaging machines and planned layout in the packing department. A drive to reduce the number of reject vials has also been instituted by a continuous weight check, and the result of all these labours is a production rate of 25,000 vials a day. Oddly enough, this increase has required no extra staff or working hours. Production study is responsible for most of it, and several members of the staff have attended courses on the subject. Suggestions from staff are regularly implemented, and colour and music during working hours are provided to remove any suggestion of drabness.

Midlands Discussion Group

The next and final meeting for this session of the Midlands Analytical Methods Discussion Group is to be held on 11 April at 7 p.m. in the Mason Theatre, The University, Edmund Street, Birmingham, when the subject to be discussed will be 'Some Developments in Chromatography.' The discussion will be opened by Dr. T. R. E. Kressman, chief research chemist, The Permutit Co., and Mr. R. A. Wells, of the Chemical Research Laboratory, Teddington.

• OVERSEAS •

U.S. Steel Production

United States steel mills are operating at 100.9 per cent of the industry's theoretical capacity and it is expected that production will shortly exceed two million tons a week for the first time in history. Further cutbacks on the civilian use of steel, tin, nickel and tungsten are expected. Crude oil production in the United States rose to a record daily average of 5,960,000 barrels; this reflects the increased crude oil production recently authorised by Texas authorities.

New Hormone Drug

A successor to cortisone for fighting arthritis and other crippling diseases, as well as bronchial asthma and eye diseases has recently been successfully synthesised in the United States. It is Kendall's Compound F, a substance first isolated from the same place as cortisone—the adrenal cortex. Once the medical world is convinced of the drug's usefulness, the new synthesis promises to make substantial supplies available soon. The drug's action is similar to cortisone, but with fewer harmful side-effects.

Oil from Coal in South Africa

Location for the South African Government's oil from coal project has now been fixed at Coalbrook, Orange Free State. This small town with a population of a little over 100, has been chosen because it is situated in an area which can supply quantities of low grade coal suitable for conversion. Vereeniging is, however, only 15 miles distant, and it is expected that many of the employees to be employed may live there. The increased expenditure on this propect recently announced by the Minister of Finance should, according to the South African Coal, Oil and Gas Corporation, enable the planned output to be nearly doubled. Target date for production is stated to be 1955.

New South African Agency

With the particular object of supplying raw materials to South African chemical firms a new agency to represent British and overseas chemical manufacturers has been established by Ben Hayden (Pty.), Ltd., P.O. Box 9096, Johannesburg.

New Oil Well in Trinidad

Trinidad's first undersea oil well was struck off Guapo, on the south coast, on 23 March, by Kern Trinidad Oilfields, a British company. Oil was struck at a depth of 3,300 ft., and a yield of 150 barrels a day is reported. Technical aid was contributed by Trinidad Leaseholds and United British Oilfields.

Construction Planned

A proposal has been made for the construction in Ecuador of plants for the manufacture of rayon, caustic soda and sulphuric acid. For this purpose assistance would be sought from the Export-Import Bank of Washington and the Central Bank of Ecuador to finance in equal parts the cost of the machinery, which is estimated at U.S. $1.9 millions. In addition to the foregoing amount it is planned to raise 6 million sucres from Ecuadorean industrialists.

Canadian Trade Fair

The fourth Canadian International Trade Fair, which will take place in Toronto, Canada, from 28 May to 8 June, 1951, will be substantially bigger this year than ever before, and will contain a more comprehensive variety of goods. So far 20 countries have applied for space; with applications continuing to arrive steadily from all over the world, it appears likely that space booked will greatly exceed that occupied in the 1950 Fair. The scientific instruments section houses exhibits from four countries, and present prospects indicate that by Fair time many more exhibitors will be showing in this category. The Scientific Instrument Manufacturers' Association of Great Britain have reserved a large space in this section to show the products of their member-firms, thus following up the successes they achieved with their exhibit in the 1950 Fair.

Increased Salt Output in Holland

Dutch salt production reached 73,000 metric tons in January and February this year compared with 57,000 tons in the first two months of 1950. The demand for chlorine and caustic soda is stated to be largely responsible and this is borne out by the growing electrolysis of salt.

PERSONAL

DR. W. H. GARRETT, M.B.E., director of Monsanto Chemicals, Ltd., recently received a special presentation from the Association of Chemical and Allied Employers on the occasion of his retirement after three years as chairman of the executive board. The ceremony took place at the annual general meeting of the association t the Mayfair Hotel. Dr. Garrett, who has already been a member of the executive board of the association for twenty-one years and was vice-chairman for four years, was elected vice-president of the association and thereby becomes a permanent member of the board. As chairman of the association Dr. Garrett has for three years been a leader of the employers' representatives on the Chemical Industries Joint Industrial Council, of which he was chairman in 1948 and 1950.

The Council of Liverpool University have appointed DR. E. C. ROLLASON, aged 43, M.Sc., Ph.D., F.I.M., to the Henry Bell Wortley Chair of Metallurgy, on the impending retirement of PROFESSOR C. O. BANNISTER. Dr. Rollason was educated at Birmingham University. He spent some years in industry until being appointed senior lecturer in the department of metallurgy at Birmingham University in 1935. In 1940, however, the doctor was seconded to Murex Welding Processes, Ltd., to pursue important war researches, and later became research manager and a director of the company. In addition to serving as examiner with the Union of Educational Institutions, the City and Guilds Institute, Birmingham University and Aberdeen University, and as assessor for the National Certificate in Metallurgy, he has published two books and a large number of papers in scientific journals.

MR. F. G. JACKSON, manager of the Central Personnel Department at Fort Dunlop, has been appointed deputy works director of their Calcutta factory. Mr. Jackson, who is 43, is a Somerset man and has been with Dunlop since he left Felsted in 1926, with a war interval of five years in the R.A.F. He left by air for India on 27 March.

MR. SYDNEY N. DUGUID, J.P., B.Sc. Tech., F.Inst.F., F.R.San.I., has joined the staff of Messrs. Powell Duffryn Technical Services, Ltd., London, and has taken charge of their branch office at 26 Corporation Street, Manchester 4. Mr. Duguid has devoted all his business life to fuel efficiency and smoke abatement. He is at present a member of the Council of the Institute of Fuel and chairman of its North Western Section. He is also chairman of the National Smoke Abatement Society.

Obituary

Prof. E. A. Werner

The death has recently taken place in Dublin of PROFESSOR E. A. WERNER, who was professor of Applied Chemistry at Dublin University from 1904 to 1928, and professor of Chemistry from 1928 until 1946, when he resigned. He was the author of numerous papers on organic chemistry.

His son, Dr. Anthony Werner, is adviser on the cleaning of oil paintings at the National Gallery, London.

Dr. W. E. Bachmann

The death occurred on 22 March of DR. WERNER EMMANUEL BACHMANN, Ph.D., professor of chemistry in the University of Michigan, at the age of 50. Educated at Detroit Junior College, he was instructor in chemistry at Michigan University from 1925 to 1939 in which year he became professor of his Faculty. He had also spent some time at the universities of Zürich and Munich and in 1935 was attached to the Royal Cancer Hospital, London. During the war the doctor invented a process to simplify and quicken the production of explosives, which was claimed to save the U.S. Government considerable capital expenditure. Among his many awards, Dr. Bachmann was the recipient of the Henry Russell award and the Presidential Certificate of Merit. From 1941 to 1946 he was associate editor of the *Journal of the American Chemical Society*, and assisted in editing a number of journals on scientific subjects.

HIGH EFFICIENCY

. . . at *Low Cost*

THE "Nivoc" Filter Pump (registered design No. 859863) is the outcome of a series of experiments made in our laboratories on a wide range of materials for the pump body, and with many types of design. The final design is extremely efficient and highly resistant to the severe conditions encountered in most chemical laboratories.

The pump is particularly efficient at low water pressure, a vacuum of 12 mm. of mercury being easily obtainable at 12-15 lb per sq. in. This characteristic eliminates pump-back under widely fluctuating water-pressure.

Nivoc Filter Pump, Catalogue No. ND211 (for attaching with rubber tube to standard laboratory taps. **8/6 EACH**

An alternative fitting for B.S.P. ¼ in. thread is described in leaflet P.1919.

The range of Nivoc Burners, Clamps and Bosses is described in recently issued leaflets Nos. P.1916a, P.1907 and P.1908. Please write for copies.

W & J GEORGE & BECKER LTD

17-29 HATTON WALL • LONDON • E.C.1 Tel: CHA 6011-4 & HOL 5483-5

157 GREAT CHARLES ST • BIRMINGHAM • 3 Tel: CENtral 7641-3

LABORATORY FURNISHERS. MANUFACTURERS OF SCIENTIFIC APPARATUS, BALANCES AND WEIGHTS. SUPPLIERS OF CHEMICALS AND ANALYTICAL REAGENTS.

W.40

The Stock & Chemical Markets

DESPITE the impending Budget, markets have again given a cheerful display, with buyers predominating in most sections, although generally the volume of business was restricted and the uptrend in prices was attributed mainly to absence of selling. The latter was due to the good impression created by the substantial revenue surplus for the past year, which led to the view that after all the Chancellor may not impose heavy new taxation.

Hopes that income tax may not be increased have been largely responsible for the further sharp rally in British Funds at the time of writing. Industrial shares were better in many cases despite general fears that the profits tax may be raised from its present level of 30 per cent. Even if this was increased to as much as 40 per cent, many leading industrial shares would have reasonable prospects of being able to maintain their dividends; and on this basis yields at current prices seem attractive in many cases.

Many investors have kept out of markets in recent weeks, but are expected to return after the Budget when there may be a general rally unless tax changes are very severe. If, as is suggested in some quarters, there were a capital gains tax, this would of course mean a set-back in market values and a much smaller volume of business on the Stock Exchange.

A feature in chemical shares has been the strength of Imperial Chemicals, which at the time of writing have risen sharply to 47s. in response to higher dividend talk. Sentiment was also helped by the new sulphuric acid plant project, in which Fisons and Courtaulds may also take a financial interest according to recent reports.

Fisons have strengthened to 26s. 6d. at the time of writing, Courtaulds to 42s. and elsewhere, Laporte Chemicals 5s. units were again around 10s. Brotherton 10s. shares have been active up to 22s. in anticipation of good financial results, and Albright & Wilson 5s. shares were active up to 18s. Monsanto at around 61s. 9d. remained an active feature on further consideration of the excellent results and share bonus. Higher dividend talk tended to draw attention to William Blythe 3s. shares which were dealt in around 9s. 4½d. Cooper McDougall & Robertson advanced to 31s. 3d. on the surprise dividend increase. Burt Boulton & Haywood changed hands up to 27s. 6d.

British Glues & Chemicals at 22s. 9d. moved in favour of holders. Turner & Newall (93s.) held their good rise and Babcock & Wilcox at 71s. 6d. were also good on prospects of higher dividend. United Molasses changed hands around 56s. 6d., while in response to the big profit increase shown by the results, British Oxygen rose to 94s. 4½d. Borax Consolidated displayed firmness at 65s. 6d., and the 4s. units of the Distillers Co. had a firmer appearance at 20s. 6d.

Market Reports

LONDON.—There has been little change in the general movement of industrial chemicals and reports from most sections of the market indicate a continued pressure for supplies. While the news that a supplementary allocation of American sulphur would be made available to the United Kingdom is welcome news of outstanding interest, the chief feature of the week has been the very substantial rise in the price of acetic acid, acetic anhydride, butyl alcohol, butyl acetate, and ethyl acetate. The producers announce that the increases are due to the substantial rise in the cost of ethyl alcohol. The new prices for acetic acid are as follows: 1 ton lots, 80 per cent technical, £110; 80 per cent pure, £116; commercial glacian, £130; all quotations delivered buyers' premises in returnable barrels. Acetic anhydride has risen from £118 to £166 per ton. The new prices for solvents have now been announced. Butyl acetate is quoted at £263; butyl alcohol £250; and ethyl acetate £174 per ton for 10 ton lots. The higher controlled prices for pig lead have had a drastic effect on Convention quotations for red and white lead. The new prices are as follows: dry white lead £185 per ton, white lead ground in oil £201 10s.; red lead £178, orange lead £190 per ton, red lead ground in oil £199, orange lead ground in oil £211, dry litharge £178 10s. In other directions quotations are firm and the tendency in most cases is towards higher levels. The acute shortage of many of the coal tar products has made for quiet conditions in the market and there are very few spot parcels on offer. [continued on page 544

Law & Company News

Company News

F. W. Berk & Co., Ltd.

It is announced that ordinary shareholders of F. W. Berk and Co., Ltd., have accepted the rights offer to the extent of over 98½ per cent. The balance of shares not taken up by way of rights were allotted to satisfy as far as possible, small applications for additional shares.

British Oxygen Co., Ltd.

Net profit for the British Oxygen Co., Ltd., group for 1950 was £1,301,197 compared with £1,156,725 in the previous year. The 20 per cent dividend in force since 1946 is maintained, the final 12 per cent being payable on the ordinary stock as increased by last year's issue.

Monsanto Chemicals, Ltd.

An extra-ordinary general meeting of Monsanto Chemicals, Ltd., has been called for 24 April to create the capital for the scrip and cash issues. The scrip bonus capitalises £1,800,000 of share premiums for a two-for-one issue to holders of ordinary shares on 12 April. The new shares will not rank for dividend in respect of 1950. The cash issue is of 1,500,000 redeemable cumulative second preference shares on terms to be decided later.

British Industrial Plastics, Ltd.

Extension of its technical service department to make a complete unit offering free advice to moulders on all problems and the addition of a design department to assist firms contemplating having goods made in plastics was announced in the report for the year ended 30 September, 1950 of British Industrial Plastics, Ltd. Profit, for the group, after taxation, was £111,201 (£90,087). A new capital issue was foreshadowed.

Increases of Capital

The following increases of capital have been announced: LANGLEY-SMITH & CO., LTD., from £50,000 to £58,936; ISOTOPE DEVELOPMENTS, LTD., from £250,000 to £50,000; LEWIS BERGER (OVERSEAS HOLDINGS), LTD., from £1,750,000 to £1,870,000.

Market Reports

continued from page 542]

MANCHESTER.—Price conditions have been very firm in all sections of the Manchester chemical market during the past week, with the outstanding advances in refined glycerine, and in the copper, lead and zinc compounds. Offers are scarce in several sections of the market, with manufacturers well sold forward. A steady demand from home consumers has been reported this week for the alkalis and the potash, magnesia and ammonia compounds, with buyers pressing for contract deliveries. Export inquiry has been on a fair scale. Fertilisers are meeting with an improved seasonal demand, and their is a full absorption of supplies of most of the tar products.

GLASGOW.—In general, business in the Scottish heavy chemical market is fairly steady and in view of the many shortages of raw materials and chemicals, business is becoming more difficult. The export market is very slow.

B.D.M.A. Officers

The following officers were elected at the annual general meeting of the British Disinfectant Manufacturers' Association held on 16 March, 1951:—

Chairman: MR. R. G. BERCHEM (Jeyes' Sanitary Compounds Co., Ltd.); *vice-chairman*: MR. A. E. BERRY (Milton Antiseptic Ltd.); *honorary treasurer*: MR. VICTOR G. GIBBS (William Pearson, Ltd.). *Executive Committee*: MR. T. C. BETTERIDGE (Cooper McDougall & Robertson, Ltd.), MR. A. J. BLACK (Lehn & Fink Products, Ltd.), SIR KNOWLES EDGE, Bart. (William Edge & Sons, Ltd.), MR. W. A. C. HALL (Prince Regent Tar Co., Ltd.), MR. W. M. MACMILLAN (Robert Young & Co., Ltd.), MR. W. MITCHELL (Hull Chemical Works, Ltd.), *Secretary*: MR. W. A. WILLIAMS, M.B.E., B.Sc.

Pyrites from Spain

Mr. H. Rhodes, Parliamentary Secretary to the Board of Trade, has stated, that this country is receiving from Spain sufficient quantities to maintain the sulphuric acid plants designed to work on this material.

Chemicals from Natural Gas

THE new chemical plant to be built at Edmonton, Alberta, by Celanese Corporation of America, will cost $40,000,000 (approximately £13,333,000) it is reported from Canada. Announcement of the plan for the factory was made in New York by Harold Blancke, president of the corporation. There was no official estimate of the cost. The plant will use Alberta natural gas to manufacture basic organic chemicals never before produced in Canada. The plant, which will require several hundred acres, will be built in the refinery area of Edmonton's eastern outskirts, and will employ several hundred persons.

In Lethbridge, Alberta, N. E. Tanner, Minister of Lands and Forests, said the establishment of the large petro-chemical and cellulose-acetate plant near Edmonton was the 'biggest thing that has happened to Alberta since the oil strike at Leduc. This plant will make one of the most significant additions to the development of this province in many years.'

Glycerine and Metal Prices

INCREASES in the price of refined glycerine in the United Kingdom and Eire as from 1 April have been announced by Glycerine, Ltd., London. New prices range from: 278s. per cwt. for lots of over 25 tons; 279s. in lots of five to 25 tons; and 280s. 6d. from one to five tons in 1 cwt. drums (charged 30s.); to: 275s. per cwt. for lots over 25 tons; 276s. in lots of five to 25 tons; and 277s. 6d. from one to five tons in 10 cwt. drums (charged 120s.). Refined pale straw industrial glycerine 1.260 s.g., 5s. per cwt. less than chemically pure. New prices will be applied to all glycerine released by the Control on or after 1 April. Releases dated March will be charged at the old rates, even though they may be invoiced in April.

Increased prices for copper, lead and zinc were announced by the Ministry of Supply on 2 April. Electrolytic copper was raised by £8 to £120 per ton; good soft pig lead went up by £24 to £160 per ton, and good ordinary brand zinc was increased by £9 to £160 per ton. Discounts, premiums and charges for forward delivery remain unaltered.

CLASSIFIED ADVERTISEMENTS

PUBLIC APPOINTMENTS

NORTH WESTERN GAS BOARD,
Liverpool Group.

APPOINTMENT OF INDUSTRIAL SALES ENGINEERS.

APPLICATIONS are invited for the above appointments within the salary range Provinical "A", A.P.T. Grade 7 £450/£530 per annum. The successful applicants may be required to pass a medical examination and to subscribe to such scheme of superannuation as the Board may adopt. Applicants should preferably have had experience in the operation of Industrial Gas Appliances or heat process work and should possess the Higher Grade Certificate of the Institution of Gas Engineers (Supply) or Higher National Certificate in Mechanical Engineering or equivalent qualification.

Letters of application, giving details of experience and stating age and qualifications, should be addressed to the **Chief Personnel Officer, Radiant House, Bold Street, Liverpool, 1,** to be received not later than 14 days from the publication of this advertisement.

SITUATIONS VACANT

CHEMIST aged 22-35 required of B.Sc. or A.R.I.C. standard for Organic Chemical Works near Birmingham. The duties include investigations on works processes and are varied and interesting. Applicants should possess initiative and persistence. A Contributory Pensions Scheme is in operation. Apply Box No. C.A. 3007, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

DEVELOPMENT GROUP MANAGER required by the Division of Atomic Energy (Production), M.O.S. Factory, Capenhurst, Nr. Chester, to supervise and participate in research work at a large chemical plant.

Candidates must either have an honours degree in physics, associateship of the Institute of Physics or equivalent qualifications and have had at least five years' experience in research and development work. They should, preferably have had special research experience on problems related to kinetic theory or the properties of matter. A doctorate would be an advantage. Salary will be assessed according to qualifications and experience within the range £997-£1,192 p.a. A voluntary superannuation scheme is in operation. A house will be available within a reasonable period for the successful candidate, if married. Applications to **Ministry of Supply, D.AT. EN.(P), Risley, Nr. Warrington, Lancs.,** quoting reference CC/4.

Rs. 5289. 21.3.51. I.R.

PLANT DEVELOPMENT AND PROCESS ENGINEERS qualified in Chemical Engineering or Petroleum Refining Technology, required by Bahrein Petroleum Company, Limited. Age limit, 25-40. Two-year agreement periods with passages and paid leaves. Free air-conditioned accommodation, board and medical attention, kit allowance, low living costs. Salary according to experience. Write, with full particulars of age, education, experience, to **Box 3784, c/o Charles Barker & Sons, Ltd., 31, Budge Row London, E.C.4.**

REQUIRED—CHEMIST, young, qualified in detergents, disinfectants, etc., to carry out tests and experiments, and to supervise processes in works. Permanency for the right man. Applications must be accompanied by the fullest details of experience, references, age and salary required, which will be treated in strict confidence. Box No. C.A. 3008, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

SITUATIONS VACANT

ENGINEERS with degrees in Mechanical or Chemical Engineering are required for The Bahrein Petroleum Company Ltd., Persian Gulf, who have openings for (*a*) men not over 40 years of age with three or more years experience in oil refining, coal tar or chemical distillation plants; (*b*) graduates with experience to train in various phases of their process, design and development work. Living costs are low the company providing free board, air conditioned accommodation and medical attention. Kit allowance, and provident fund. Write with full particulars of age, experience and education to Box 4035 c/o Charles Barker & Sons Ltd., 31 Budge Row, London, E.C.4.

THORIUM LIMITED, will appoint a **RESEARCH MANAGER** to take charge of their research laboratories at Ilford. Applicants should have good Honours degrees in chemistry and should have post graduate research or industrial experience in inorganic chemistry. The successful applicant will be required to direct work in connection with any new developments, more particularly in the Rare Earth field. Salary will be in the range £1,000-£1,250 and will depend upon qualifications and experience. There is in existence a contributory pension fund. Applications should be made to the **General Manager, Thorium Limited, 10, Princes Street, Westminster, London, S.W.1.**

FOR SALE

CHARCOAL, ANIMAL and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—**THOS. HILL-JONES, LTD.,** "Invicta" Mills, Bow Common Lane, London, E. Telegrams, "Hilljones, Bochurch, London," Telephone: 3285 East.

STORAGE TANKS

400 gallons rectangular enclosed, 6′ × 3′2″ × 3′ 6″.
500 gallons cylindrical petrol tanks, new, 5′ 9″ × 4′ 6″.
1,700 gallons enclosed, steam heating coils.
2,250 gallons vertical cylindrical enclosed, 9′ 6″ diam. × 5′ deep.
4,000 gallons open top cast iron sectional.
4-7,000 gallons converted boiler tanks 30′ × 7′.
12,000 gallons unused cylindrical tank 30′ × 9′.
12,800 gallons creosoting tank 52′ 6″ × 7′.

WILLIAM R. SELWOOD, CHANDLER'S FORD, HANTS.
'PHONE 2275.

PHONE 96 STAINES

TWIN "Z" blade **TIPPING MIXER,** 30 in. by 26 in. by 20 in. deep.
Six unused Brass Shell **CONDENSERS,** 3 ft. 6 in. by 5 in. diam., with 325—$\frac{1}{4}$ in. copper tubes.
Triple Roll Steel **REFINERS,** 22 in. by 12 in. and 22$\frac{1}{2}$ in. by 11 in. diam.
Copper Jac. **VACUUM PAN,** 7 ft. by 3 ft. diam., with condenser and vacuum pump, by "Blair Campbell."
Two Stainless Steel Cased **ELEVATORS,** 19 ft. 6 in. and 40 ft. centres.

HARRY H. GARDAM & CO., LTD., STAINES

1000 STRONG NEW WATERPROOF APRONS, To-day's value 5s. each, Clearing at 30s. dozen. Also large quantity Filter Cloths, cheap. Wilsons Springfield Mills, Preston Lancs Phone 2198.

FOR SALE

VARIOUS MIXERS FOR SALE

BAND CONVEYOR, 50 ft. long 40 in. wide, steel frame motorised, for boxes, cases, bags, etc.

A FILTER PRESS, 31½ in. square, fitted with 42 C.I. plates, centre fed.

1½, 2½ and 3½ size belt-driven **DISINTEGRATORS** by Christy & Norris or Harrison Carter.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS** and one size 3W Miracle **GRINDING MILL.**

One Hind & Lund steam jacketed **DRYER**, with " U "-shaped trough 5 ft. long.

One Broadbent under-driven **HYDRO EXTRACTOR**, self-balancing type, with self-contained A.C. motor.

Two FILTER PRESSES, fitted recessed C.I. plates, 40 in square, 2½ in. thick, centre fed, to make 11 cakes per Press.

One Lilleshall **FILTER PRESS**, fitted 18 C.I. plates, 36 in square, and 19 C.I. frames, with side inlet, side enclosed delivery and usual fittings.

Kek GRINDING MILL, square pin type, with grinding discs 13 in. diam., including circular delivery bin with single outlet.

Large unjacketed **WERNER MIXER**, belt and gear driven, hand tipping, double " Z " arms, pans 53 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCOPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double " U "-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the top of the tipping screw.

No. 204 One **WERNER PFLEIDERER MIXER OR INCORPORATOR**, similar to the above, with a C.I. built pan 25 in. by 25 in. by 19 in. deep, belt pulleys 26 in. diam. by 5 in. face, double fin-type agitators, and mounted on C.I. legs.

No. 209 One **HORIZONTAL " U "-SHAPED MIXER**, steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

No. 210 One **HORIZONTAL MIXER** as above.

These three " U "-shaped mixers are in some cases fitted with steel plate covers and a steam jacket round the bottom and extending to within about 18 in. of the top with plain end plates.

Further details and prices upon application.

Write RICHARD SIZER LIMITED, ENGINEERS CUBER WORKS, HULL

FOR SALE

600

DRYING MACHINERY

INFRA-RED DRYING TUNNEL by Met.-Vick, overall 26 ft. long by 3 ft. 9 in. wide by 5 ft. 5 in. high. Conveyor 18 in. wide for trays 25 in. by 16½ in., driven by ¼ h.p. 400/3/50, geared motor. Electrical loading is 15 kW, 110V, wired in 2 series for 200V, single phase and controlled by five 3-heat switches.

Two steam jacketed **ROTARY VACUUM DRYERS**, each 17 ft. 3 in. by 4 ft. 6 in. diam. Manhole in barrel with cover. Mounted on roller tracks and driven through glanded trunnion bearings. Discharge through S.J. chamber.

Horizontal **TROUGH MIXER DRYER** by R. Simon. Internal dimensions, 8 ft. long 2 ft. 6 in. deep by 2 ft. 8 in. wide. Agitator is bank 16 solid drawn tubes, 6 ft. 6 in. long by 2½ in. o.d. Tubes tested to 150 lb. sq. in. Chain and sprocket drive. 8 in. square bottom side discharge.

TWIN ROLL DRYER by Simon. Steam-heated rolls 5 ft. by 4 ft. diam. Roll pressure, 80 lb. sq. in. Complete with galvanised worm discharge conveyors, and hood. Vee-belt driven from 15 h.p. Higgs motor, 400/3/50, 730 r.p.m. through reduction gear.

TWIN ROLL DRYER by Simon. Steam-heated rolls, pressure 80 lb. sq. in., 5 ft. by 4 ft. diam. With galvanised worm discharge conveyors and hood. Vee-belt driven by 15 h.p. geared motor by Higgs, 400/3/50. Speed 1,420/101 r.p.m.

DRYING INSTALLATION by Manlove-Alliott of Nottingham, comprising **ROTARY DRYER** 60 ft. long by 6 ft. diam., of ¾-in. plate, 2 roller paths, drive on to main girth gear through open reduction gear. Bennis unit patent travelling grate stoker, 43½ sq. ft., grate area for furnace at feed end, also Dust Extraction Plant by Sturtevant, comprising 32-in. steel-cased fan and two 11 ft. diam. cyclone dust collectors.

GEORGE COHEN, SONS & CO., LTD.,
SUNBEAM ROAD, LONDON, N.W.10
Tel.: Elgar 7222 and
STANNINGLEY, NR LEEDS
Tel.: Pudsey 2241

VERTICAL Egg-ended **PRESSURE VESSELS**, 5 ft. by 12 ft. 6 in. 100 lb. p.s.i. ¼ in. plate.

Unused Baird & Tatlock, 8 gallon **REFRACTIONATING VACUUM STILL** in Copper.

Horizontal Steam **JACKETED MIXERS** by Werner Pfleiderer, 26 in. by 28 in. by 24 in., double " Z " Blades, Power Tilting.

Heavy Copper Horizontal **VACUUM MIXERS**, cylindrical, from 80 gallons to 500 gallons, with motor drives.

NEW STAINLESS STEEL VESSELS in stock 25/250 gallons.

REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS, CUBA STREET,
MILLWALL, E.14.
'Phone: East 4081

3 M.S. Welded Jacketed **PANS**, 24 in. diam by 26 in. deep, 1½ in. bottom outlet, mounted on angle legs. Tested 100 lb. hydraulic pressure.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET, LONDON E.14.
Tel.: East 1844.

8 COPPER-jacketed **MELTING PANS**, 18 in. diam. by 12 in. deep, fitted covers, mounted in M.S. frames 25 in. by 25 in. by 44 in. high, with flanged fittings, valves and steam traps. As new.

THOMPSON & SON (MILLWALL) LIMITED
CUBA STREET, LONDON, E.14.
Tel. East 1844

FOR SALE

MORTON, SON & WARD LIMITED
offer the following

THREE 450 gallon m.s. **JACKETED BOILING PANS**, 5 ft. diam. by 3 ft. 6 in. deep, dished bottoms, bottom outlets, certified for 50 lb. p.s.i. w.p.
TWO 100 gallon m.s. **JACKETED BOILING PANS**, bottom outlets, certified for 100 lb. p.s.i. w.p.
FIVE 200 gallon s.s. rectangular **TANKS**, radii-ed corners, 2 in. folded rim.
ONE tilting **TROUGH MIXER** by Baker Perkins, 2 speed double "Z" contra rotating blades, hand tilting gear, trough 3 ft. by 2 ft. deep.
4 ft. 6 ft. and 8 ft. "Morward" **TROUGH MIXERS**, with double scroll stirring gear, electrically driven through reduction gears, hinged lids, hand wheel operated discharge.
TWO totally enclosed horizontal **MIXERS**, 9 ft. by 3 ft. 6 in., gate type agitators, electrically driven, bottom centre outlet, two manholes on top.

HYDRO EXTRACTORS

TWO 48 in. by **BROADBENT**, all electric.
THREE 42 in. by **WATSON LAIDLAW**, all electric.
TWO 36 in. by **BROADBENT**, all electric.
THREE 30 in. by **BROADBENT**, all electric.
ONE 30 in. and **ONE** 26 in. by **BROADBENT**, belt driven.

All suitable for 400/3/50 supply and complete with cabinet starters.
Your specific plant enquiries solicited.
MORTON, SON & WARD LIMITED
WALK MILL, DOBCROSS, Nr. OLDHAM, Lancs.
'Phone: Saddleworth 437

PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD. (B. T. King A.M.I.Mech.E., Patent Agent), 146a, Queen Victoria Street, London, E.C.4. ADVICE Handbook, and Consultation free. Phone: City 6161.

WORKING NOTICES

THE Proprietor of British Patent No. 574803, entitled **"APPARATUS FOR THE TREATMENT OF BLOOD"** offers same for license or otherwise to ensure practical working in Great Britain. Inquiries to **SINGER, STERN & CARLBERG**, 14 E, Jackson Boulevard, Chicago 4, Illinois, U.S.A.

THE Proprietors of Patent No. 596121 for **"IMPROVEMENTS IN OR RELATING TO PURIFICATION OF CELLULOSIC MATERIALS,"** desire to secure commercial exploitation by Licence in the United Kingdom. Replies to **HASELTINE, LAKE & CO.**, 28, Southampton Buildings, Chancery Lane, London, W.C.2.

THE Proprietor of Patent No. 598602 for **"METHOD OF PRODUCING COPOLYMER RESINS AND PRODUCTS DERIVED THEREFROM,"** desires to secure commercial exploitation by Licence or otherwise in the United Kingdom. Replies to **HASELTINE, LAKE & CO.**, 28, Southampton Buildings, Chancery Lane, London, W.C.2.

SERVICING

CRUSHING, GRINDING, MIXING and **DRYING** for the trade.
THE CRACK PULVERISING MILLS, LTD.
49/51, Eastcheap, E.C.3
Mansion House, 4406.

"DOHM LTD., PULVERISING" raw materials everywhere, 167, Victoria Street, London, S.W.1.

GRINDING of every description of chemical and other materials for the trade with improved mills. **THOS. HILL-JONES, LTD.**, "Invicta" Mills, Bow Common Lane London, E. Telegrams: "Hilljones, Bochurch, London," Telephone: 3285 East.

Printed in Great Britain by THE PRESS AT COOMBELANDS, Ltd., Addlestone, and published by BENN BROTHERS LTD., at Bouverie House, 154, Fleet Street, E.C.4, 7 April, 1951. Registered at the General Post Office. Entered as Second Class Matter at the New York U.S.A., Post Office.